H. Haeman

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SURGICAL WARD-WORK AND NURSING

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AND

NURSING

A HANDBOOK FOR JUNIOR STUDENTS OF MEDICINE, AND NURSES

BY

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WITH ONE HUNDRED AND NINETY-NINE ILLUSTRATIONS

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To

A. G. MILLER, Esq.

SENIOR SURGEON TO THE ROYAL INFIRMARY EDINBURGH

THIS LITTLE WORK IS RESPECTFULLY DEDICATED

BY HIS FORMER PUPIL AND HOUSE SURGEON

THE AUTHOR

PREFACE

At the foot of the ladder of surgical literature there appears to the author still to be a step awanting. The junior student and the nurse-probationer entering on the duties of the surgical ward, require a guide more minute and detailed than is furnished by any of the excellent works on minor or practical surgery now at their command.

In the hope of filling this gap, rather than with a desire to traverse ground already so satisfactorily occupied, this little work is sent out. To the experienced nurse or the senior student, there may be in it much that appears elementary, perhaps even trivial; but they may be reminded that there was a time when they were ignorant of it, and that the present comfort of their patients depends more on careful attention to the minutiæ of surgical technique, than on the appreciation, by them, of the broad principles of the science. "There is no real elevation of mind in a contempt for little things."

I gladly embrace this opportunity of expressing

my thanks to Miss Marion Stenhouse, Staff-Nurse, Royal Infirmary, Edinburgh; and to Miss S. M. Ferrier, of the Rio Tinto Hospital, Huelva, Spain, for many useful hints on practical points connected with the nurses' duties; and to my friend, Dr. A. B. Giles, for valuable aid in correcting and revising proofs.

To several makers of surgical instruments, I am also much indebted for kind permission to make use of their illustrations.

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SURGICAL WARD-WORK AND NURSING.

SECTION I.—ANTISEPTIC SURGERY.

CHAPTER I.

GENERAL PRINCIPLES OF ANTISEPTIC SURGERY.

In the present day, when the Listerian method of wound treatment predominates over all others, and guides every surgical procedure, it is essential that its first principles should be thoroughly grasped by all who, even in the humblest capacity, take part in any surgical operation or dressing.

The great aim and object of this system is the prevention of putrefaction, or as it is called in surgery, Sepsis, in the discharges of wounds. Before considering how this desirable end is to be obtained it will be necessary to glance briefly at the nature and causes of the process.

The word sepsis is derived from the Greek verb *septo, I putrify*, and is used to indicate the series of chemical changes which goes on in the discharges and tissues of an unhealthy wound.

It is an every-day experience that animal matter placed under certain conditions undergoes decomposition by putrefaction, the conditions necessary being, first, that the tissue be dead, or at least devitalised; second, that it contain

a certain amount of fluid; third, that it be kept at a particular temperature; and, last and most important, that certain minute fungi or micro-organisms gain access to the tissue. Of this combination of circumstances essential to the process, it will be evident that at least the first three exist in every surgical wound. The tissues in virtue of having been injured are to some extent devitalised—"below par"—in some instances indeed actually dead. The discharges—blood and serum—and the normal fluids of the body tissues furnish the necessary moisture; while the ordinary temperature of the body, 98°·4 F., is highly favourable. But a wound will not become septic unless the fourth factor be added to the others. The germs, microbes, or as we prefer to call them, *micro-organisms*, must reach the wound, where they find a suitable "nidus" for their growth and development, ere the septic process is established.

Some authorities hold that if a wound be kept absolutely dry organisms may be introduced with impunity, but others deny this. It is acknowledged by all that dryness is prejudicial to the development of the septic organisms, hence the importance of keeping wounds free from blood and discharge by carefully arresting all hæmorrhage and securing free drainage.

Fig. 1

Micro-organisms are divided into various classes according to their shape. Thus we have (1) *Micrococci*, which are small round organisms, sometimes aggregated into clusters, *Staphlyococci* (Fig. 1); sometimes arranged in chains, *Streptococci* (Fig. 2); (2) *Bacteria* (Fig. 3), which are rod-shaped and about twice as long as they are broad; (3) *Bacilli* (Fig. 4), also rod-shaped, but longer than bacteria; and (4) *Spirilla* (Fig. 5) or thread-like organisms. Each micro-organism, to whatever class it belongs, is practically a small cell, consisting of a minute mass of protoplasm, bounded by an envelope, and in some cases containing a quantity of coloured pigment, the commonest shades found being yellow, orange, red, and blue,

Fig. 2.

Fig. 3.

They are all so minute as to require very high powers of the microscope to render them visible, or for the study of their structure and life changes.

Fig. 4.

For their nutrition these organisms require a supply of hydrogen, nitrogen, oxygen, and carbon, and in many cases some phosphate. This they obtain by breaking up the elements of the tissues in which they find a suitable habitat, this breaking-up process being what we know as sepsis or putrefaction. Not only do they disorganise the tissue in which they actually live, but, in addition, each variety of organism produces some poisonous chemical substance, known as its *ptomaine*, and it is the absorption of this poison by the patient that produces the blood-poisoning associated with septic wounds; and as different organisms produce different ptomaines we have many clinical varieties of septic poisoning. In some cases the organisms themselves pass into the blood and lymph streams, and so get disseminated throughout the body, starting fresh foci of infection, and consequently increased production and absorption of ptomaines.

Fig. 5.

Micro-organisms of many varieties are exceedingly abundant under almost every condition of ordinary life, in the atmosphere we breathe, in the water we drink, on our clothes, our furniture, and even on our skin, so that unless every precaution be taken to prevent it they are almost certain to gain access to our wounds. The omnipresence of septic agents is a fact constantly to be borne in mind by all who have in their hands the treatment of surgical patients.

The three words *septic*, *aseptic*, and *antiseptic*, so constantly used in relation to wounds and their treatment, will, in the light of what has just been said, be now quite intelligible. A septic wound is one in which the process of putrefaction has been established and is going on; while a wound which is aseptic (*a* not, and *septo*) is free from putrefaction. The term antiseptic (*anti* against, and *septo*) is applied to anything which will counteract the process by

destroying the vitality of the organism causing it. It must be remembered that a wound may remain aseptic either because organisms have never gained an entrance to it, or because the tissues of the patient have been strong enough to combat the germs, and so to ward off their attack. It is a well-established axiom that "healthy tissue is our best antiseptic."

Importance of Asepsis in Wounds.—The importance of preventing sepsis in surgical wounds cannot be exaggerated. It makes the difference between successful and unsuccessful surgery, in many cases between the life and death of the patient. To mention that among septic diseases such affections as septicæmia, pyæmia, erysipelas, hospital gangrene, malignant pustule, and a host of others are to be numbered, will indicate the desirability of guarding our patients from the attacks of organisms, or of destroying these should they be present.

As we go on we shall find that it is only by attending to the minutiæ of antiseptic surgery, and by giving the most scrupulous attention to apparently trivial details that we can hope to command success.

Asepsis is the ideal of modern surgery, and in the light of recent discoveries and extended experience in the Listerian methods, it should be attainable in all cases where the skin is unbroken when the patient comes under the care of the surgeon. Unfortunately many patients have already been infected with septic organisms before seeking or obtaining surgical aid, and with them our endeavours must be directed to counteracting the effect of these, by improving the health of the tissues, and by a judicious use of antiseptic agents external and internal.

CHAPTER II.

ANTISEPTIC LOTIONS.

SUCH, briefly stated, are the general principles on which the system of antiseptic surgery is based, and we may proceed to consider its practice.

There are many antiseptic lotions now in use, and it will not be necessary to enumerate, much less to describe, all of them. There are three, however, which are so universally employed, and so efficient, that we shall say a few words about each; they are:—(1) Carbolic acid lotion; (2) Corrosive sublimate lotion; (3) Boracic acid lotion.

(1) *Carbolic Acid Lotion.*—This agent is of much historical interest, being that employed by Sir Joseph Lister when he introduced the antiseptic system about the year 1865. It is a substance derived from coal-tar by a complicated process of distillation, and in its pure, strong form is in long white crystals. As a lotion, however, it is used largely diluted with water. One part of the acid is dissolved in nineteen parts of water, and forms a lotion, spoken of as "one in twenty carbolic." This is the strongest carbolic lotion in common use, and for many purposes it is too strong. As a rule, a lotion half that strength, spoken of as "one in forty," is what is used in ordinary surgical operations and dressings.

It is common in large hospitals to have on the table two bottles, labelled respectively, "Carbolic acid, 1 in 20," and "Carbolic acid, 1 in 40." Sometimes, however, only 1 in 20 is kept, and the weaker lotion is made by diluting this with an equal quantity of water. The lotion, if pure, is quite clear, and should it be the least turbid, impurities which will irritate the skin may be suspected.

Caution!—It must be borne in mind that carbolic acid is

very poisonous, and the bottle should always bear a prominent poison label. Not only is it deleterious when taken by the mouth, but when large quantities are used at an operation, or when a carbolic dressing is applied over a large area, such as an ulcer or burn, it may be absorbed, and give rise to unpleasant symptoms, such as giddiness, nausea, and vomiting. As some people are peculiarly susceptible to the action of carbolic acid, it is always necessary to keep a sharp look-out on the patient, and if he show any of these unpleasant symptoms this lotion should be discontinued, and some other substituted. Evidence that the lotion is being absorbed is often to be found in the urine, which is passed of an olive-green colour, and on standing becomes almost black. This in itself is not a dangerous condition, but should be accepted as a hint that the patient is intolerant of the drug, and as an indication for making a change.

The chief *advantages* of carbolic lotion are:—(1) Its cheapness; (2) its volatility; (3) that it does not injure instruments or sponges.

Its *disadvantages* are:—(1) Its being poisonous by absorption; (2) its being irritant to the skin of some patients.

Uses.—1 in 15: For spray. *1 in 20:* (1) To purify skin of patient; (2) to purify hands of surgeon and assistants; (3) to purify sponges and instruments; (4) to prepare gauze; (5) to prepare dipped towels. *1 in 40:* (1) For operation lotion; (2) for dressing lotion.

Preparations.—The various forms in which carbolic is employed are:—(1) Liquefied carbolic acid; (2) glyceride of carbolic acid; (3) carbolic acid and soap suppository; (4) carbolic ointment; (5) carbolic oil (non-official); (6) carbolic wool (non-official); (7) carbolic gauze (non-official).

(2) *Corrosive Sublimate Lotion.*—This antiseptic is much used in the present day. It is a preparation of mercury, and goes by various names—"corrosive lotion," "perchloride," "bichloride," "sublimate," and sometimes simply "mercurial lotion."

The perchloride of mercury is a white crystalline substance, and is extremely poisonous. The lotion is made

by dissolving the powder in distilled water. It is antiseptic in very much diluted forms, up to 1 in 5,000 being often used. The commonest strength in use, however, is 1 in 2,000. It is customary to keep the ward stock of 1 in 1,000, and to dilute it with equal parts of tepid water when 1 in 2,000 is required.

It is unfortunate that this lotion corrodes metallic instruments, which somewhat restricts its use, and this property should always be borne in mind, as otherwise expensive and delicate instruments may be destroyed by purifying them with it. On this account also, tin basins must not be used for corrosive lotion, the tin being instantly corroded, losing its polish, and turning the lotion black. Glass or porcelain dishes, or, better still, basins covered with a layer of enamel, must be employed.

So also with syringes. A brass syringe should never be used with corrosive lotion, always a glass or vulcanite one.

As far as possible, sponges should never be put into corrosive lotion, because, although it does not actually destroy, it permanently blackens them.

Corrosive lotion is easily rendered non-antiseptic by adding a quantity of blood or pus to it. The albumen of the blood or pus acts on the solution, forming an albuminate of mercury, which is not antiseptic. Therefore, the lotion should be changed very frequently during an operation. One can tell when this action has taken place by the thick brown deposit which falls to the bottom of the basin, resembling very much the sediment of strong beef-tea. The addition of a quantity of common salt to the lotion prevents this deposit.

Caution!—Corrosive sublimate is a most deadly poison if taken by the mouth. It should therefore always bear a prominent poison label, and be placed in some position where children or delirious patients cannot reach it. Like carbolic, it may also produce symptoms of poisoning by being absorbed through the skin, or from a wound. These symptoms are diarrhœa, vomiting, and collapse, which may be followed by rapid death. A large moist dressing of corrosive sublimate should never be applied, nor should macintosh ever be used outside of such a dressing to pre-

vent evaporation, because the contact of the lotion with the skin produces irritation, and absorption rapidly follows.

The *advantages* of corrosive lotion are :—(1) Its cheapness ; (2) being non-volatile it remains antiseptic ; (3) its efficiency ; (4) its general applicability.

Its *disadvantages* are :—(1) Its poisonous properties ; (2) it corrodes instruments, tins, etc. ; (3) it blackens sponges.

Uses.—1 in 500 : (1) For washing out septic cavities (care being taken not to leave any in the cavity) ; (2) for purifying the skin ; (3) for purifying the surgeon's hands. This strength is rather irritating for the surgeon's hands, but its efficiency is undoubted. *1 in 1,000 :* Same uses as 1 in 500. This is the strength which should be kept in the stock bottle. *1 in 2,000 :* (1) For irrigating at operations ; (2) for irrigating at dressings, etc. This strength may be used for almost any purpose, being efficient, safe, clean, and readily procurable. It is made by taking a quantity of 1 in 1,000 in an enamelled basin, and adding to it an equal quantity of tepid water, thus bringing the strength down to 1 in 2,000. *1 in 5,000 :* (1) In ophthalmic surgery ; (2) As a vaginal douche in gynæcology, etc. It is prepared by adding four times as much water as 1 in 1,000.

Preparations.—(1) Corrosive sublimate lotion ; (2) "yellow wash" contains 1 part corrosive sublimate to 243 parts lime water ; (3) corrosive wool (non-official) ; (4) wood wool (non-official). Many other materials are charged with corrosive sublimate to render them antiseptic.

(3) *Boracic Acid Lotion.*—This, which also goes by the name of boric lotion, has the great advantage over corrosive and carbolic lotions of being practically non-poisonous. It is only a very weak antiseptic, which "may prevent, but cannot eradicate sepsis." It is a saturated solution of boracic acid crystals in water. A "saturated" solution means that the water is allowed to dissolve as much as it will of the drug. Hence it is impossible to use a lotion of boracic acid which is too strong, because the water refuses to take up more than 1 in 30, this forming the usual efficient lotion. To make it, add an ounce of the crystals to a pint of *boiling* water (because boiling water dissolves more than cold), and allow it to cool, when the

excess of acid falls to the bottom again in the form of crystals. The stock lotion bottle should always have a few crystals at the bottom, as an indication that it is sufficiently strong. In some hospitals the boracic lotion is coloured pink by adding some litmus to it. This is merely that it may be readily distinguished from other lotions by its colour, and is by no means necessary for its efficiency. In some exceptional cases it acts as an irritant on the skin, producing an acute eczematous condition.

The *advantages* of boracic lotion are :—(1) Its cheapness; (2) its absolute safety; (3) it is non-irritating as a rule; (4) it is said to have sedative properties—hence the name "Homberg's Sedative Salt."

Its *disadvantages* are :—(1) That it is not a sufficiently powerful germicide to warrant its use in important operations; (2) that it does not counteract sepsis; (3) that it sometimes produces eczema.

Uses.—(1) To clean and dress wounds of all sorts; (2) as an eye wash; (3) as an ear wash; (4) as a mouth wash or gargle; (5) as a nasal douche; (6) is particularly useful for washing out the bladder; (7) as a vaginal or uterine douche. For all these purposes it should be used tepid, and it is better to heat the full strength lotion than to add hot water, as the latter method diminishes its strength.

Preparations.—(1) Boracic lotion; (2) boracic ointment; (3) boracic lint; (4) boroglyceride; (5) impalpable boracic acid powder; (6) impalpable boracic acid powder with chalk, an excellent dusting powder for infants and others.

CHAPTER III.

ANTISEPTIC POWDERS AND UNGUENTS.

Of antiseptic powders in common use, the chief are iodoform, powdered boracic acid, and mixtures of these with other substances.

Iodoform.—This substance is practically a preparation of iodine, and is met with in three forms:—(1) Crystals, large, irregular, rough, and coarse; (2) powder, which is simply these large crystals crushed and broken down into small, regular, golden-yellow particles; and, best of all, (3) precipitated powder, which is a fine flour-like impalpable powder.

In whichever form it occurs, it has a peculiarly persistent and somewhat disagreeable odour, which may be masked, or at least altered, by various means, such as tincture of musk, tonquin bean, or balsam of Peru. It is said to have an anodyne action when applied locally, and is sometimes used in painful affections of the rectum as a suppository, on this account. It is not a powerful antiseptic, but has a specially beneficial action in tubercular affections, and in certain venereal diseases. It seems to act by chemically altering the ptomaines in such a way as to render them less harmful. It is used largely to dust over operation wounds and at the subsequent dressings, but in aseptic cases need only be used sparingly.

In all conditions in which the discharge has a disagreeable odour, such as septic abscesses, open cancers and so on, iodoform is a very valuable application, its own characteristic odour serving to mask that of the discharge.

Carbolic or plain gauze is often charged with iodoform, and used as a deep dressing or to stuff cavities. For the latter purpose one long strip of gauze is preferable to a

number of shorter strips, as it is more easily removed, and there is no risk of leaving any in the wound. Iodoform should be kept in a cool, dry place.

Caution!—In children and in old weakly people, symptoms of iodoform poisoning are said to occur when large quantities have been used, and especially if the powder has been blown into cavities and left there. These symptoms vary much, and differ in the young and old. It seems quite probable that the symptoms assigned to iodoform absorption are really those of other complications entirely. They are, loss of appetite, mental depression or excitement, and sometimes more grave brain symptoms. Should these occur the drug must be discontinued and the patient stimulated.

Its chief *advantages* are:—(1) Its general applicability; (2) its general efficiency; (3) its special action in tubercular and venereal diseases; (4) its deodorising properties; and (5) its anodyne properties; and its *disadvantages* (1) its expense; (2) its persistent odour; (3) its alleged poisonous properties.

Uses.—(1) To dust on all wounds, especially tubercular and venereal; (2) to dust on the conjunctiva in purulent conjunctivitis; (3) to dust on to the peritoneum in laparotomy; (4) as an insufflation for nose, ears, rectum, etc.; (5) to charge gauze for stuffing cavities, etc.; (6) as a deodoriser, *e.g.*, in cancerous ulcerations; (7) in erysipelas.

Preparations.—(1) Iodoform powder; (2) iodoform ointment; (3) iodoform suppositories; (4) iodoform wool (non-official); (5) solution in ether. This is painted on to the wound, and when the ether evaporates a coating of iodoform is left.

ANTISEPTIC UNGUENTS.

In spite of the advances which have been made in the preparation of antiseptic agents, we still seem to be in want of a satisfactory antiseptic unguent or oil. Those in ordinary use for the lubricating of catheters, bougies, exploring needles, etc., have each some disadvantage, some are irritating, others are unreliable as germicides.

(1) *Carbolic Oil* consists of 1 part of carbolic acid dissolved in 5, 10, or 15 parts of olive oil, according to the strength required. Although this preparation is often recommended for antisepticising catheters, hypodermic needles, etc., it is by no means a certain agent. "The value of these oily compounds is very doubtful, as they have been found to have no influence on germs" (Mitchell Bruce). When freshly prepared it may be efficient, but it has been shown that after standing for a short time, it loses all its germicidal power and is simply a plain oil. The author has tested a large number of samples of so-called carbolic oil found in various hospital wards, and has almost without exception found them to consist of simple olive oil.

Carbolic oil, therefore, should never be used to disinfect instruments unless it is perfectly freshly *prepared;* to be fresh from the shop is not sufficient—it may have stood there long enough.

(2) *Eucalyptus Oil*, or eucalyptol, is the oil distilled from the fresh leaves of the plant of the same name—a species of gum tree. It is used in surgery mixed with olive oil in the proportion of 1 in 6. It is of a pale straw colour, and has an agreeable aromatic odour. It is a fairly reliable antiseptic, and on this account, as well as because it is less irritating, it is preferable to carbolic oil.

(3) An unguent, of which the following is the recipe—

℞. Vaselini
Olei vaselini aa ℥iiss
Cocain (alkaloid) 4 per cent
Olei eucalypti ℥i

has been found very useful for lubricating urethral instruments. It is a good antiseptic, and the cocaine seems to soothe the urethral mucous membrane, preventing subsequent spasm and urethral fever.

CHAPTER IV.

MATERIALS FOR DRESSINGS.

Varieties of Wool.—Wool is very largely used in surgery for padding splints and other appliances, and as a part of almost every dressing. There are different varieties of wool, some plain, others charged with antiseptic agents.

(1) *Plain Wool.*—This is ordinary cotton wadding made up in sheets about half an inch thick, and having one side covered with a paste which keeps the wool together. This material is not charged with any antiseptic, nor is it absorbent, and must never on any account be used in dressing an open wound, for padding splints in the setting of a compound fracture, or for any part connected with a discharging sore. For these purposes antiseptic wool of one kind or another must be employed.

Plain wool may only be used as padding for splints in cases of simple fracture, or where one is dealing with unbroken skin.

The paste backing should be peeled off before the wool is used, as it interferes with the escape of the skin secretions, which are apt to cause irritation when retained.

(2) *Corrosive Sublimate Wool.*—This is fine white cotton wool, which has been rendered antiseptic by impregnation with corrosive sublimate. It is used in the dressing of all open wounds, and for padding splints and other appliances which are to come near sources of discharge. The advantage of this wool lies, of course, in its being antiseptic, but it must be borne in mind that the pus and blood render the corrosive no longer antiseptic by forming with it an albuminate of mercury. Hence, so soon as ever a dressing gets soaked with discharge it is no longer *anti*septic, but only *a*septic, and should organisms gain access to it, it will

soon become *septic*. The practical application of this is, that when using corrosive wool a sharp look-out must be kept on the discharge, which must never be allowed to get through the bandage. If it should do so in spite of watchfulness, *at once* re-dress the wound, otherwise the chances are it will become septic, as pus in a warm, moist pad of wool forms an excellent nidus for germs, and germs never lose an opportunity of establishing themselves.

(3) *Wood Wool*.—This is made by subjecting chips of pine wood to certain chemical processes, by which the oils and resins are removed, and the remaining substance is rendered very absorbent. It is charged with corrosive sublimate to make it antiseptic, and has the advantage of being much more absorbent than ordinary corrosive wool. When saturated with discharge, it, too, loses its antiseptic properties.

(4) *Salicylic Wool* is fine cotton wool charged with salicylic acid. Two strengths of the antiseptic are used, the stronger containing 10 per cent. by weight, the weaker 3 per cent. The excess of powdered acid which comes off the wool is apt to irritate the eyes and nasal mucous membrane of those around, setting up in some people a violent coryza. For this reason it has been given up by many surgeons.

It will thus be seen that each of the varieties of wool mentioned has certain disadvantages: some are irritating, others are rendered non-antiseptic by discharges, and all are expensive.

Practical Points.—There are one or two points of importance in preparing the wool for a dressing or operation. Wool must never be allowed to lie exposed to the air and its inevitable dust and germs. It is best kept clean by being placed in well-closed tin boxes; or failing these, it should be kept rolled up in the thick paper in which it is sold. As it comes from the chemist, it is in long thick rolls, each weighing about a pound. It will be found convenient to cut these rolls into pads about a foot square, and place them one above another in the boxes. As wool will only tear in its *long axis*, it is easier, and wastes less wool, if the sheets be cut *across* with scissors.

Lint.—(1) *Plain or Surgical Lint* is a soft material, made by scraping old linen cloth, and is used as a dressing in certain cases. It is not antiseptic, therefore its use is much restricted. It may be covered with antiseptic ointments, oils, etc., and applied to open sores. The two sides of lint are different—one is plain, the other is woolly—and the question is often asked, which side should go next the wound? It is very much a matter of taste. It will be found that one can spread ointment more evenly and with greater ease on the plain side. The plain side is less apt to stick into a sore, and the dressing is thus removed more easily, and with less pain to the patient. On the other hand, when applying lint to an unbroken surface, the woolly side is the softer, and absorbs skin secretions better.

(2) *Boracic Lint* is ordinary surgical lint which has been soaked in a hot, saturated solution of boracic acid, and then hung up to dry. It is thus rendered an efficient antiseptic, and as the boracic acid is non-volatile, it retains this property. It should, however, never be applied next a wound *dry*, as its germicidal power is greatly increased by moisture. It is usually tinted pink by means of litmus, to distinguish it from ordinary lint, and is often covered with an excess of boracic acid crystals deposited as the lint cools. It is exceedingly absorbent of discharges. In every way boracic lint is a most valuable material, being cheap and handy, only requiring to be moistened to furnish a fairly efficient antiseptic dressing for all minor injuries, such as cut hands, scalp wounds, small ulcers, and so on. It also forms a good deep dressing in more important cases. Another use to which it is often put is to cover the limb before applying a plaster case or extension strapping. Boracic lint is preferred to plain for this purpose, being toxic to fleas and other body insects—a point of great importance in our out-patient departments.

Advantages.—(1) Cheapness; (2) fairly efficient antiseptic; (3) almost universal applicability; (4) very absorbent; (5) toxic to fleas, etc.

There are one or two other substances which are in constant use in surgical practice.

Oiled Silk or Protective consists of thin sheets of oiled silk coated on both sides with copal varnish, to render the silk impervious to fluid. Over this a layer of carbolised dextrine is painted, but as the carbolic soon volatilises from the dextrine it loses its antiseptic properties. It is not used nearly so much nowadays as it used to be. Its object is to prevent adhesion of the other dressings to the edges and surface of the wound, to protect the raw edges of the wound from irritation by carbolic or other antiseptics, and to facilitate the escape of discharge, which soaks out all round its edges, and is thus more evenly distributed in the wool. When a drainage tube is being used, a hole is cut in the protective and the tube drawn through it, the protective preventing the safety-pin irritating the skin. In dressing large *healing* ulcers of all kinds, but especially those resulting from burns, it is of great importance that the margins should be very gently dealt with. It is here that the healing process is going on, and it is evident that if any dressing be applied which will adhere to the wound this delicate epithelium will be removed at each dressing, and the healing process consequently retarded. To prevent this, the growing epithelial margin should be covered with thin strips of protective carefully purified.

Gutta-percha Tissue.—As its name implies, this is a very thin sheet of gutta-percha. It is used to put outside deep dressings or fomentations when it is desired that these should remain moist, as it prevents evaporation of the fluid in the dressing. Non-antiseptic, it requires purification before being used, but must not be dipped into *hot* lotion, which softens and destroys it. Excellent finger-stalls can be made with gutta-percha tissue one or two layers thick. The edges are easily fixed by a drop of chloroform, or better still, by the flame of a lighted match. It has been found useful also for making small ice bags to apply to a hernia-cerebri, and for other purposes.

Macintosh or Pink Jaconette is a thin cotton cloth with a layer of india-rubber waterproofing over it, invented by Syme. Like gutta-percha tissue, it is used to prevent moist dressings becoming dry by evaporation. Its chief use, however, is to protect the patient's clothing and the bed

during an operation or at dressing. For this purpose it is cut into sheets, about a yard square, the edges being left unhemmed. It must never be folded up while damp, as the adjacent surfaces adhere and it is spoiled. Carefully avoid sticking pins into macintosh, as the holes made allow lotion to run through, and permit of evaporation from fomentations, etc.

Gauze.—(1) *Carbolic Gauze.* This is a rough unbleached muslin, which has been rendered antiseptic by being charged with a mixture of carbolic acid, resin, and paraffine. The paraffine prevents the gauze adhering, while the resin fixes the volatile carbolic acid, and so prevents, to some extent, the evaporation of it, so long as the gauze remains dry, and below the temperature of the body. At one time it was largely employed as a deep dressing, but is now almost entirely used for making bandages.

(2) *Plain or Surgical Gauze* is a loose cotton cloth, rendered absorbent by having its oily matter removed by boiling in soda. It is soft, open, and porous, and for its bulk absorbs a large amount of discharge. It is cut into strips, and folded so as to make pads six or eight layers thick, and about four inches square. It is antisepticised by being kept in 1 in 20 carbolic for about a fortnight before being used. As the carbolic is apt to irritate the skin, the gauze pad should be wrung out of corrosive, or some other less irritating antiseptic, before being applied to the wound as a deep dressing. These pads are of great use, as they can take the place of protective, or be used as a deep dressing, or even as sponges.

(3) *Double Cyanide Gauze.*—Sir Joseph Lister uses plain gauze, charged with the double cyanide of mercury and zinc, which is a fixed non-irritating and reliable antiseptic. It should be kept in glass jars slightly *damp* with carbolic acid. It is on no account to be dipped in corrosive sublimate before being used, as a triple salt is thus formed, which is but a feeble antiseptic, and is, moreover, exceedingly irritating, producing vesication of the skin.

Bandages and Slings will be treated of later. Suffice it now to say that there are certain bandage materials which are antiseptic, *e.g.* carbolised gauze, double cyanide of

mercury and zinc gauze, and domette which has been impregnated with sal-alembroth; and others which are non-antiseptic, such as plain cotton and ordinary domette, and one or other of these materials will be selected according to the nature of the condition under treatment, having regard to whether or not an antiseptic is indicated.

CHAPTER V.

LOTION BASINS.

BEFORE going further it may be convenient to mention the various tins, basins, and other appliances usually found in a surgical ward, and the uses to which these are put.

(1) *Lotion Basins.*—These may be made of plain tin, or of tin covered with a coating of enamel. The former are to be used only for carbolic or boracic lotions, as corrosive destroys them. The enamelled tins are specially made for corrosive, but of course are equally suitable for the other lotions. The basins are of various sizes, and should never be more than half full.

(2) *Solution Tins* differ from lotion basins in having perpendicular sides, and in being provided with a handle. They are made of plain tin, and are used to steep sponges, towels, etc., in carbolic lotion. They are often used also to hold pus, serous fluid, or other discharges, and for various other purposes.

(3) *The Kidney-shaped Basin* (Fig. 6) is described by its name. It is a shallow tin or enamelled vessel, used to catch up discharges as they escape, *e.g.* pus from a large abscess. On account of its shape it can be accurately applied to the surface of almost any part of the body, so preventing any soiling of the patient's clothes or sheets. All tins which are brought into contact with wounds should be thoroughly purified with carbolic (1 in 20) lest they carry germs on to the wound.

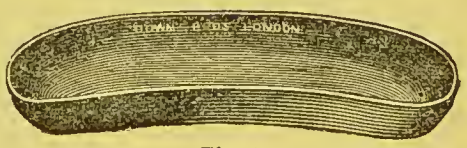


Fig. 6.

(4) *Bleeding Cups* (Fig. 7).—These small saucer-shaped dishes, although not now employed for their original purpose, are still very useful, and should be found on every

ward table. They are made of tin, and are usually graduated, so that the quantity of discharge caught in them may be measured. They are often used in place of the kidney-shaped basin, the same precaution being taken with regard to purifying their edges. They are found useful receptacles for the parts removed at operations, *e.g.* excised parts of joints, tumours, and so on.

Fig. 7.

(5) *Leg Tray.*—This is a long, shallow, oval tray, used in dressing wounds of the leg. At the upper end is a broad flange hollowed out to permit of the thigh resting on it, while the lower part of the leg lies over the tray into which all discharge and lotion escape.

(5) *The Dirty-dressing Tray* is a large shallow tray, placed under the bed or operating-table to receive the dressing removed from the patient and any other refuse which may require to be disposed of during the procedure. When the dressing is finished the tray should *at once* be removed from the ward and emptied, the soiled dressings being burned, and the macintoshes, etc., washed, purified, and dried.

CHAPTER VI.

WARD TABLE AND DRESSING TRAY.

HAVING indicated the various materials and utensils in every-day use, and some of the more important practical points in connection with each, it may be convenient to recapitulate in a tabular form the furnishings of a ward table and dressing tray.

Ward Table.—The arrangement of the ward table is so much a matter of individual taste, that one cannot lay down rules with regard to it. On it should be found—

(1) A Winchester jar of carbolic lotion, 1 in 20.
(2) „ „ corrosive lotion, 1 in 1,000.
(3) „ „ corrosive lotion, 1 in 2,000.
(4) 20-ounce jar of corrosive lotion, 1 in 500.
(5) A Winchester jar of boracic lotion, saturated.

All these jars should have glass stoppers, and be carefully labelled. They should all be marked "Poison," and must not be within the reach of children.

(6) Eucalyptus oil (1 in 6).
(7) Unguent for urethral instruments.
(8) Vaseline.

These should be in wide-mouthed glass bottles, containing about four ounces of each.

(9) Iodoform.
(10) Boracic powder.

These should be in wide-mouthed glass bottles, covered with fine gauze firmly fixed on with an india-rubber band, for dusting.

(11) Drainage tubes.
(12) Pads of plain gauze.
(13) Antisepticised safety pins.

The tubes and gauze are best kept in wide glass jars,

about six inches high and four inches in diameter; the pins (to be used only for transfixing drainage tubes) in a small glass bottle with a stopper. The carbolic lotion in which all these are kept should be frequently changed, as it loses in strength by volatilising.

(14) A small box containing sulphate of copper (blue stone).

In addition, there should always be at hand—

(15) Four to six lotion basins of different sizes, plain and enamelled.
(16) Two kidney-shaped basins.
(17) Two bleeding cups.
(18) Two solution tins.
(19) One leg tray.
(20) One dirty-dressing tray.
(21) One pail with close-fitting lid for hot water.
(22) One pail to hold dirty lotions, etc.
(23) One Higginson's syringe.
(24) One brass or glass syringe.

Dressing Tray.—This may be of wicker-work or tin, about one and three-quarters to two feet long, by one foot broad, and about two inches deep. It should contain a supply of—

(1) Plain surgeon's lint.
(2) Boracic lint.
(3) Protective.
(4) Gutta-percha tissue.
(5) Gauze bandages (carbolised and double cyanide).
(6) Domette bandages (plain and sal-alembroth).
(7) Linen bandages (plain).
(8) Adhesive plaster.
(9) Corrosive wool and wood wool (in tin boxes with close-fitting lids).
(10) Safety pins.
(11) A pair of scissors.
(12) A pair of dressing forceps.
(13) A pair of sinus forceps.
(14) A pair of dissecting forceps.
(15) A probe.
(16) A measuring tape.

CHAPTER VII.

ANTISEPTIC DRESSING.

A Simple Antiseptic Dressing.—Having now considered the general principles of antiseptic surgery, and the means at our disposal of applying these principles, we shall go on to study the practice itself. It is the duty of the dresser or nurse to make all the preparations necessary for the dressing of a case by the surgeon, when he makes his ward visit, and this includes not only the preparation of the patient himself, but of all the dressings, lotions, instruments, etc., that may be used. There is no way in which a nurse can show her capabilities better than in the performance of this apparently simple duty. She must take every precaution that the patient is not unduly exposed, or wearied more than is absolutely necessary; and she must make certain that she has everything at hand that can possibly be wanted, so that there will be no delay during the dressing by things having to be sent or searched for. She must also carefully watch the steps of the process as it goes on, and *anticipate* the surgeon's wants. This "faculty of anticipation" is one which must be cultivated by all who take part in surgical work whether as assistant, dresser or nurse. It should be the aim and ambition of a surgical nurse never to require to be asked for anything during a dressing, but always to have the required article ready to the surgeon's hand just at the moment it is needed. This is of importance to the patient as well as to the surgeon, because many people, and especially women and children, are much more frightened than pained by being dressed, and their fears are increased if there is a constant conversation going on between the surgeon and the nurse as to what is being done. The less talking that goes on at the dressing the better. If by any chance the nurse

should have forgotten something, and should notice her mistake just when the dressing is beginning, she should take some opportunity of going to rectify it when her services are not required. She should not rush off immediately she notices the omission, just, perhaps, when she is wanted to hold a limb, or remove a bandage, but should wait till some part of the dressing which will engage the surgeon's attention for some little time, and then she can quietly and quickly go, her absence, perhaps, never being observed.

The main points to be attended to in the performance of an ordinary simple antiseptic dressing are :—

(1) *The comfort of the patient,* which must be the first care; and

(2) "*Antiseptics,*" which includes the "surgical cleanliness" of the nurses, dressers, and surgeon, as well as the sterility of the dressings.

To Prepare the Patient.—Let us suppose that the wound to be dressed is that resulting from a severe crush of the leg below the knee, and that the spray is not being used. The patient is to be protected from draughts, as well as from the gaze of other patients by the ward screens. One should be careful in arranging these to make sure that they stand firmly, and are not in danger of being knocked over; and also that plenty of room be left all round the bed, so that doctors and nurses may move about without knocking against the screens. Try to arrange the doorway between the screens so that those inside may reach it from either side of the bed without passing one another. The most convenient place is usually opposite the foot of the bed. No more of the patient's body is to be exposed to the air than is absolutely necessary, especially in cold weather; the bed clothes being arranged so that only the injured limb is uncovered, and only as much of it as is sufficient to render access easy.

To Protect the Bed.—This will be done by covering as much of the bed as comes within the area of operations with macintosh waterproof; and it will be found an advantage to fold up the edges all round so as to form a kind of gutter, that any lotion spilt on the macintosh will not

find its way on to the sheets. The same end may be attained by sewing a roll of wool into the edge of the macintosh all round, forming a thick border.

Carbolised Towel.—Over the macintosh is spread a towel which has been soaked in 1 in 20 carbolic and wrung out. The object of this is to have an antiseptic surface next the wound, so that if by any chance it comes in contact with the bed, septic contamination is rendered impossible. Instruments, sponges, and dressings can be laid with safety on this towel. The precaution of the dipped towel is one which is not always taken, even in hospitals where the antiseptic system is supposed to be carried out in all detail; and some surgeons open abscesses with nothing but a macintosh on the bed, and from this they lift their instruments, sponges, and drainage tubes. No one supposes that a macintosh is antiseptic, or even aseptic, and it seems unreasonable that a wound should be douched with carbolic lotion and covered with antiseptic dressings while such a simple and obvious precaution as the carbolised towel is systematically neglected. The towel has another advantage, that it prevents soiling of the sheets by absorbing a considerable quantity of the lotion which runs off the wound. From a nurse's point of view this is a sufficient reason for using it even should she feel that it is not her place to suggest the antiseptic precautions to her chief. When the leg-tray is used, the macintosh should be laid under it, and the carbolised towel over it, so that by the former the sheets are protected, while the latter secures an antiseptic surface next the wound, without interfering with the escape of lotion into the tray.

Personal Cleanliness.—As it is the duty of the dresser or nurse to hand up the dressings to the surgeon, it is of the utmost importance that they themselves should be "surgically clean." By this term is meant that they should be free from every kind of septic germ, which, gaining access to the wounds, might set up putrefaction. If then the nurse should have been working with anything likely to be a fruitful source of sepsis, such as a septic abscess or ulcer, she should change her apron before assisting at an aseptic dressing. Under all conditions she mus:

purify her hands. Observe we do not say "wash" her hands, that is not sufficient for surgical purification. She must carefully purify with soap, soda, and tepid water, use the nail brush freely, thoroughly rub the hands all over with spirits of turpentine, which is a powerful antiseptic, and is not injurious to the skin, and then dry with a fresh clean towel.

If the nurse has occasion to touch the limb, especially if near the wound, or any dressing or instrument which goes into contact with the wound, she must not neglect first to dip her hands. This word "dip" is rather unfortunate in this connection. Too often the hands are only dipped. They should be thoroughly rubbed over with the lotion, with the aid of a swab of wool. It may appear to be carrying antiseptics too far to insist on these minutiæ; but if we are going to adopt antiseptic principles at all, no details are too insignificant to claim our attention.

If it be necessary that the nurse's hands should be pure, it is evidently at least equally important that the surgeon's should be. It is the nurse's duty to see that the necessaries for this are ready. A liberal supply of tepid water, soap, powdered carbonate of soda, a nail brush, turpentine, and a clean towel. Cold water should never be used for this purpose, even in warm weather, because it is not so good for cleaning the hands, and it cools them down and renders them uncomfortable to the patient.

The Lotion.—It will depend on the nature of the wound and the tastes of the surgeon what particular lotion is used in each case. Let us suppose the corrosive sublimate (1 in 2,000) is what is wanted. Take two enamelled lotion basins, and put into each a quantity of 1 in 1,000 corrosive, adding an equal quantity of tepid water to bring it down to the proper strength. Tepid water is added in preference to cold, being more comfortable for the patient. Do not add more than half fills each basin. Into one basin put a small amount of corrosive wool to use as a swab for washing the wound. Sponges should never be used for ward dressing, as being used for all sorts of cases they simply become a vehicle for spreading sepsis. The lotion in the second basin is to be used for syringing out the wound, and into

it nothing must be put. If carbolic lotion (1 in 40) be used, 1 in 20 is diluted with equal parts of tepid water, just as is done with corrosive; but with boracic it is better to heat the full strength lotion than to further dilute it with water.

Syringing of Wounds.—Without here discussing the advisableness of syringing wounds, we shall only say a few words as to how it should be done when necessary. There are many kinds of syringe available, but perhaps the best for all purposes is the Higginson, fitted with a long narrow metal nozzle, which may be passed to the bottom of a wound.

By it you can get a constant stream, the strength of which can readily be varied, and the flexible tubes allow it to be applied in any direction. Of the barrel syringes, perhaps the best is that made of glass. It is cheap, can be used with corrosive sublimate, is easily kept clean, and the presence of air in it is readily detected. Whichever form of syringe is employed, it is most important to expel all air from it before introducing it to the wound, as the air may carry with it the elements of putrefaction. With the Higginson's syringe, the best way to make sure of the absence of air is to keep the weighted end of the tube in a considerable depth of lotion, expelling all air from the tubes, by running a stream through for a short time. When using the barrel and piston syringe, fill it very slowly, and when the piston-rod is withdrawn to its full extent, hold the nozzle straight up in the air. This enables what air is in the barrel to rise to the surface. Now push up the piston-rod till a jet of fluid escapes and expels the air in front of it. Do not be deceived by a small jet which often comes at the very first push in a badly working syringe; wait till a full stream comes from the nozzle. Having filled the syringe and expelled the air, place it in the second basin with the nozzle well under the lotion, so that no more air may enter. In using the syringe, introduce the nozzle to the deepest part of the wound, so that the direction of the stream is from within outwards.

Removal of Old Dressing.—Having thus prepared the patient and all the requisite materials, the next step is the removal of the old dressing. It is unnecessary to insist on the importance of gentleness in this, not only to avoid

causing the patient unnecessary pain, but also to prevent undue movement of parts in which the maintenance of rest is of immense importance in the treatment. It is often the duty of the nurse to steady the patient's limb during dressing, and she must always purify her hands before doing so, and try to hold the part in as comfortable a position as possible. Perhaps the most comfortable way for the patient in holding a leg, is to seize it by the great toe. The domette bandage should be rolled off by simply reversing the movements of putting it on. A bandage should never be removed by seizing the loose end, and describing circles round the patient's foot, coiling it up into a rope. The deeper bandages may be cut off along the front of the limb by short snips of sharp scissors, as they are not to be used again. The wool should be taken off, as it was put on, in layers, taking care not to expose the wound till you are ready to irrigate it with lotion. Wool is more easily removed dry than wet; so that unless it is sticking into the wound, no lotion should be put on the wool. In removing the deep dressing, raise the upper edge, and by a stream of lotion gradually float up the rest.

Drainage Tubes.—These are usually removed at each dressing, cleansed, and re-introduced if necessary. When removing a drainage tube carefully note the exact direction it takes in the wound, so that you may know how to re-introduce it. Should you experience any difficulty in doing this, a probe passed into the lumen of the tube, making it stiff, will often facilitate its passage. Some means must always be taken of preventing the drainage tube slipping completely into the wound, especially when dealing with cavities like the plura or peritoneum. Even in quite superficial wounds, masses of granulations sometimes grow up, completely concealing the end of the tube, which might easily be overlooked. Perhaps the simplest method is to transfix the tube with a sterilised safety pin (Fig. 8). It is

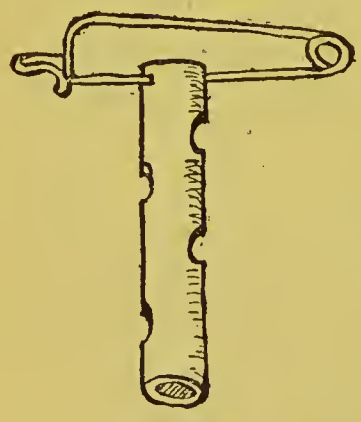


Fig. 8.

a safe rule to remove, or at least shorten a tube, when the wound forms an exact mould of it, or when the granulations begin to push it out of the wound.

Washing the Wound.—A very common mistake made by students and nurses in washing the wound, is to clean up all the skin around the actual wound first, and then with the same swab, to rub over the granulations. In other words, they carefully gather up all the refuse lying around, and deposit it on the raw surface of the wound. Of course, the proper method is to clean the wound thoroughly at the very first, and having done so, never again to touch it. Then remove all the *debris* from the surrounding parts, and proceed with the dressing.

Protective.—The parts having been thoroughly cleaned, the application of the fresh dressing is to be proceeded with. As a rule, some form of protective is placed next the wound, and that most commonly used is Lister's *oiled silk.* As we have already seen, this has the disadvantage of not being antiseptic. As sold, it is between folds of tissue paper, and it should not be removed from these till just before it is to be used. Only cut as much as is required, and put it at once into antiseptic lotion, wash it thoroughly, and apply it directly from the lotion to the wound.

When oiled silk protective is not used, small pads of *surgical or plain gauze* take its place. These have been kept for a fortnight or more in 1 in 20 carbolic, and so rendered thoroughly antiseptic. The carbolic should be washed out of the gauze by dipping it in some less irritating lotion. These pads of gauze, in addition to being antiseptic, have the advantage of being absorbent of discharge, while they do not stick into the wound like wool.

Antiseptic Powder.—Over the protective (sometimes under it) is dusted some antiseptic powder—iodoform, or boracic acid.

Deep Dressing.—When unprepared gauze is used in place of protective, no further deep dressing is necessary, but with oiled silk it is customary to apply some moist, absorbent material just outside of it. The deep dressing may either be allowed to dry, or may be kept moist by a layer of gutta-percha tissue over it. One of the most useful deep dressings

is a four-ply square of boracic lint wrung out of the lotion used for the dressing, which is found to absorb a large quantity of discharge. Outside the deep dressing another dusting of powder may be put, especially should the discharge have a bad smell.

The Wool.—This has already been so far prepared in arranging the dressing tray. It is there in large thick squares, but it must not be applied so to the wound. The quantity used will be proportionate to the size of the wound, and the amount of discharge expected. On the one hand it is necessary to guard against extravagance in the use of this rather expensive material, whilst on the other one must equally avoid a niggardly and false economy which saves wool at the expense of antiseptic efficiency. Rather use too much than too little wool. There are one or two points to be attended to in applying the wool at a dressing. Never lift a piece of wool from the tray or box and put it straight on to a wound, always split it up so as to get a fresh surface. The object in thus splitting up the wool is three-fold: (1) in order that you may have a fresh surface, on which no dust or germs may have landed to put next the wound; (2) that the wool may lie in more accurate apposition with the surface, so that it will not slip, and that air may not enter; and (3) that being loose and porous, the discharge will easily soak up into the wool, and not cake and form a hard impermeable layer next the wound.

In cases where a large amount of discharge is expected it will be well to use wood wool, taking the same precautions as to securing a fresh surface. It is more absorbent than ordinary corrosive wool, and this property more than compensates for the inconvenience caused by the excess of dust it gives off, which can be obviated by having it made up in sheets covered with fine gauze.

Bandages.—Over the wool should be put some form of antiseptic gauze bandage to hold the dressing in position, either the gauze charged with the double cyanide of mercury and zinc, lately introduced by Sir Joseph Lister, or the older carbolised gauze of the same surgeon. Attend to the following points in connection with this bandage. As carbolic acid is a volatile substance, and as the bandage

will doubtless have lain in the tray for a day or two at least, the outer layers will probably have lost their antiseptic properties, and will have had dust landing on them. The first foot or so of a guaze bandage should always be torn off before handing it to the surgeon. Select an appropriate width of bandage, and be careful to unroll a few inches of it before handing it up, as this enables the surgeon to get started with the bandage at once, a thing which is not easy when a firm roll is given him, and, as is very often the case, he has only one hand available for applying it. As a rule, a domette bandage, charged with sal-alembroth, a non-volatile antiseptic, is applied over all to secure the dressing and to support the whole limb.

Safety Pins.—The bandage is fixed by means of safety pins, of which a liberal supply should always be ready, as it is often necessary to fasten the bandage at several places, especially about the head, chest and pelvis.

Few people insert a safety pin properly. The pin should run in the long axis of the bandage. If fixed across the bandage the tension twists the pin round, the last turn gets quite loose, and the other turns soon follow.

The dressing is now finished, the patient must be made comfortable again, and the dirty dressings, macintoshes, etc., removed.

To Make the Patient Comfortable.—First remove the macintosh and dipped towel, and be careful in doing so to gather up the four corners, and then the intervening edges, to prevent the lotions and discharges soiling the sheets. Then quickly cover up the patient ; see that the bed-clothes do not press on the injured limb ; and if they do, put in a "cage" to prevent this. Should the patient complain of being cold, you may put a hot bottle beside him, taking care that it is not so hot, or so near the limb as to do damage. Never put a hot bottle close beside an unconscious patient, a very old person, or one who has had a very severe injury to his limbs, as it is liable to do harm.

Disposal of Dirty Dressings.—What is to be done with the dirty dressings which have been taken off? The domette bandage should be *at once* removed from the ward, and put into a basin of carbolic. However clean it may

appear to be, it must on no account be rolled up and put into the dressing-tray or used for another patient. If unstained, it may be used again for the same patient, but in wounds which it is important to keep aseptic—and there are few indeed which it is not—it is better never to use a bandage twice without having it thoroughly washed and recharged with antiseptic between times. Everything else should be at once burned, if this be possible, and if not, it should be removed to some place where it can contaminate nothing. On no account collect all the old dressings of the day in the ward, and remove them together at night. The carbolised towel should also be washed before being again used; and the macintoshes must be washed with carbolic and thoroughly dried before being folded and laid aside. The dressing-tray should be tidied, the wool-boxes closed, and the whole covered over with a clean towel till again required. In some hospitals it is the duty of the dresser or nurse to mark on the chart at the proper place the word "Dressed," and any remarks necessary; and this should be done *at the time*, otherwise it is apt to be forgotten and to lead to mistakes.

CHAPTER VIII.

A SPRAY DRESSING.

WE may now consider briefly one or two points in regard to the use of the antiseptic spray in the dressing of wounds.

The Carbolic Spray.—The view that atmospheric dust and germs are a fertile source of wound infection has almost entirely been abandoned, and the carbolic spray which Sir Joseph Lister introduced to counteract these agencies is now neglected. Recent investigations, however, show that the air of surgical hospitals is less innocuous than has been supposed, and that the spray may, after all, retain its place in the surgeon's armamentarium (Haegler).

As it is usually the duty of the nurse to manage the spray, it is important that she should thoroughly understand its construction and its principles, not only that she may prepare and work it properly, but also from the point of view of her own and her patient's personal safety, as it is an instrument not free from danger even in competent hands. The spray (Fig. 9) consists of three main parts: (1) The lamp; (2) the boiler; (3) the spray-producing apparatus.

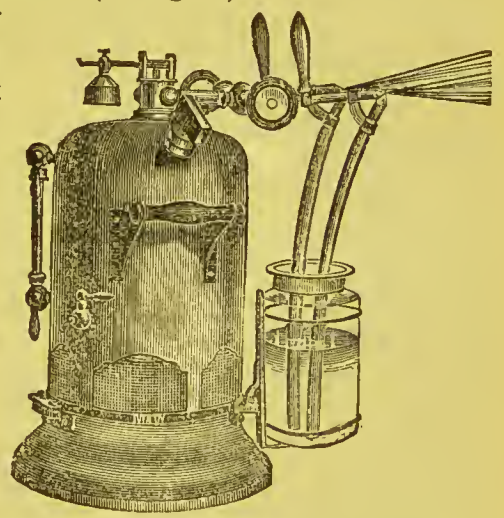


Fig. 9.

(1) *The Lamp* is a shallow, flat, brass vessel arranged on the principle of an ordinary spirit lamp, with the wick projecting from the centre of the upper surface, and, in most

cases, with a contrivance by which the size of the flame may be regulated. The lamp is filled with methylated spirit through an opening at the side, which is closed by a brass plug or screw.

(2) *The Boiler* is raised above the lamp on a light metal framework, the interspaces of which are filled in with fine wire gauze, to prevent the flame being blown into contact with any inflammable material. It consists of a metal tank to contain the water to produce the steam. On the top are (*a*) an opening through which the boiler is filled with water; and (*b*) a safety valve arrangement, which permits the escape of excessive steam when the spray is up. In some forms of spray these two parts are combined. The mechanism of these parts must be thoroughly understood, as it is by errors in the management of them that accidents happen. It is needless to say that such knowledge should be acquired on the empty spray, as otherwise it may be dearly bought.

(3) *The Spray-Producing Apparatus* consists of one or two fine nozzles, provided with stopcocks, which project from the upper part of the boiler. When these are turned on the steam rushes out, and by means of a needle projecting in front of the nozzles, is broken into a fine diffused spray. The remaining part of the apparatus is that which supplies the carbolic acid. Connected with the under aspect of each nozzle is an india-rubber tube, which dips into a glass vessel attached to the boiler, and containing a 1 in 15 solution of carbolic acid. When the steam rushes rapidly through the nozzle of the boiler, it creates a vacuum in the upper end of the elastic tubes, and, the carbolic rising to fill the vacuum, mingles in equal quantity with the steam, and is thrown out into the air in a fine cloud of antiseptic vapour. The strength of the carbolic in the air is thus 1 in 30, being diluted by the steam.

To prevent accidents, certain precautions must be taken in using the spray :—

(1) *The Lamp.*—It is well always to make sure that the lamp is full of spirit before doing anything else, and especially before lighting it. Never let the first indication that the lamp is empty, be its going out in the middle of a

dressing. Serious accidents have happened through carelessly proceeding to fill the lamp without extinguishing it. The light should always be extinguished as soon as ever the dressing is over, otherwise the water in the boiler will boil out, the solder will melt, and the apparatus be ruined.

(2) *The Boiler* should be filled about two-thirds full with water which is nearly boiling, as this saves time in getting up the steam. It should never be filled quite to the top, or there will be no place for the steam to collect, and the apparatus will not work. Another important precaution to take to ensure personal safety, is never to take out the plug in the top till the water inside has cooled down considerably, otherwise the steam will suddenly escape, and you may be severely scalded.

(3) *The Spray-Producing Apparatus.*—Of course the jar of carbolic (1 in 15) must be kept full, and the tubes clear, so that the antiseptic can get freely into the nozzles. The tubes are very apt to get blocked by particles of dust, wool, etc., sucked into them by the rush of fluid. This is easily obviated by tying a piece of fine wire gauze over the end of the tube. There are various ways by which one can tell that there is carbolic in the spray: (*a*) The *smell* of the vapour should indicate the presence of the antiseptic, but if carbolic is being used for other purposes this test may be deceptive. (*b*) The *taste* of carbolic is also characteristic. This can be detected by passing the tongue through the cloud of vapour, when the not unpleasant sweetish taste of the acid will be experienced if it be present. (*c*) The *colour* of the carbolic spray is whitish grey, compared to the electric blue of the plain steam. (*d*) The hissing *sound* of the two sprays differs considerably, but this can only be learned by experience.

The last precaution to observe in the working of the spray, is never to turn the steam *directly* on to the patient. While the spray is not working the nozzle gets filled with a quantity of very hot water, and when the steam is suddenly turned on to the patient, this is projected with great rapidity on to his skin, causing him considerable pain.

In other respects a spray dressing differs very little from another. Greater care must be taken to avoid draughts,

as any current of air blows the vapour off the wound, and the chances of organisms reaching it are much increased. Therefore, all doors, windows, and ventilators should be closed, and *kept closed*, while the spray is going, no one entering or leaving the room if it can possibly be avoided. This renders it necessary that nothing be omitted from the dressing tray which can possibly be wanted.

On account of the vapour condensing, it is necessary to protect the patient and the bed by more macintoshes and dipped towels than in an ordinary dressing, and, as many patients, especially children, object to the carbolic being blown in their faces, it is well to cover the head with a dry towel.

There is still another set of precautions to be observed at a spray dressing :—(1) Never open out a wound before the spray is going—a safe rule is, "turn on the spray as soon as ever the bandage is cut;" (2) never allow anything to get between the spray and the wound, the current otherwise is interrupted, and uncarbolised air gains access; (3) never shut off the spray till the wound is covered up—the rule should be, "so soon as the bandage is begun the spray may be stopped;" (4) if by any chance the spray should give signs of failing during a dressing, when only one nozzle is in use, you must, on no account, turn on the other nozzle in the hope that thereby you will improve matters. Doubtless you will increase the volume of steam, but it will only last half as long, so that while with one nozzle you might be able to finish the dressing with a weak though efficient spray, with two you will run short of steam before you are finished.

The Spray Stand.—This is a piece of apparatus which can easily be extemporised, but in wards where the spray is constantly used, some form of properly made stand is employed. The main requisites are that it be steady, and that it be capable of being raised and lowered at pleasure to suit the height of the bed. This latter end is usually attained by means of a telescopic arrangement.

The Value of the Spray.—Doubtless the reader will be inclined to say, after reading all these precautions, dangers, and sources of failure associated with the spray, "Is the

benefit derived from the use of it worth all the trouble and risk?" This question has been often asked, and variously answered. When Lister first introduced the spray its value was fully recognised, and it became almost universally used. At the same time, all other antiseptic precautions were increased, and the results became so good that many surgeons felt that, with efficient irrigation, the spray could be dispensed with, and for a time the pendulum of surgical opinion swung in the opposite direction, many abandoning its use. Some, however, remained faithful to it, and recently, in spite of its illustrious introducer publicly disowning it, the spray has again been more generally used. I cannot better state the case for the spray than by quoting an eminent abdominal surgeon, Mr. Knowsley Thornton, who says, "First, I believe it is useful during an operation in keeping a moist antiseptic atmosphere over everything, so that minute dry particles are immediately caught and moistened by a strong solution of a powerful germicide, while the hands of the operator and his instruments, as well as the tissues of the patient, are never allowed to become caked with dry blood or wound secretion, mixed with, and holding firmly, small dry particles from the atmosphere of the room; or, perhaps, the still more dangerous moist particles from the breath of those engaged in the operation or present as spectators. . . . This brings me to the second advantage derived from the steam saturated with carbolic" (as against plain steam). "It is urged that it is useless, because stronger solutions fail as germicides with certain potent germs, even when they are long exposed to their action. Those who argue thus forget one important element in surgery, *i.e.* the vitality and resisting power of the tissues. Now I firmly believe that this vital action may be, and is, much aided when the germs of infection are delivered over to the tissues, weakened by being soaked in a strong antiseptic; perhaps this does not kill them, but it renders them a much easier prey to the active leucocytes."

CHAPTER IX

MANAGEMENT OF SURGICAL OPERATIONS.

AFTER what has already been said of the importance of antiseptic details in connection with surgical dressings, it would be needless repetition to say more in speaking here of operations.

Operating Theatre.—This room should be large, well ventilated, and, if possible, lighted from the roof as well as by windows. It is of the first importance to see to the sanitary condition of the room in which an operation is to be performed. Early in the morning the floor, walls, and if necessary, the roof should be rubbed over with a *damp* cloth, the windows widely opened, and the theatre thoroughly aired. This having been done the fire is kindled, and proper ventilation secured and maintained. If it be particularly important that the air be thoroughly aseptic, *e.g.* in cases in which the peritoneal cavity is opened, one or two carbolic spray engines may be kept working for an hour or two before beginning the operation. Haegler's observations seem to show that the chief use of the spray is to moisten the dust particles of the atmosphere, and so cause them to fall to the ground, as a shower of rain clears the air by carrying down dust, germs, and other impurities. At the same time everything is moistened, and so dust is not raised by movements in the room. The temperature of the room should be about 65 deg. F., and there must be no draughts. The further arrangement of the theatre will depend greatly on circumstances, such as the size and shape of the room, the arrangement of the light, the number of assistants available, and the presence or not of spectators, and must consequently be left to the good sense and management of the nurse. For purposes of description,

however, we may assume a large teaching hospital, where there is no lack of assistance, and where there are usually a considerable number of spectators at operations.

Operating Table.—In the centre of the theatre stands the operating table. This may be either a fixture, or better still, arranged on wheels, so that the patient may be comfortably placed on the table in the ward, wheeled to the theatre, and the administration of chloroform commenced at once. This means of transferring the patient from the ward to the theatre is a great improvement on the stretchers or basket. A most convenient table is in use in most of the wards of the Royal Infirmary, Edinburgh. It consists of a light but strong table, mounted on light carriage wheels with moderately strong springs. The wheels are furnished with india-rubber tyres, which enables them to run smoothly and quietly. The legs are similarly finished. The table is so balanced that the weight of the patient is never sufficient to cause it to tilt up, and the head being towards the wheel end it can very readily be depressed should any accident occur during the administration of the anæsthetic. The handles by which the table is wheeled are supplied with hinges, so that during the operation they can be folded out of the way, or they may be made to telescope along the sides. Running along the sides are two brass bars, on which slide broad leather belts for securing the patient. The table is 6 ft. long, about 3 ft. high, and $1\frac{3}{4}$ ft. broad. It is covered with a thin, firm, hair cushion.

To "Set the Operating Table."—Spread on the cushion a thick sheet of india-rubber, and over this a double fold of blanket. On this the patient lies, and he is covered with one or two blankets, as may be necessary. Under his head is put a firm hair pillow, feathers being too soft. The pillow should have a macintosh pillow-slip under the linen one to prevent blood or lotion spoiling it. It will be found convenient to have a broad belt passing over the patient's chest and another just above his knees, not only to prevent him slipping off the table on the way to the theatre, but also to restrain his struggles while the anæsthetic is being administered.

Caution!—Be particularly careful, however, not to

pull the strap round the chest tight lest you should interfere with respiration. It should never be so tight that you cannot pass your arm between it and the chest wall. You will find that a strap when fixed just above a patient's knees prevents struggling very much better than when placed below the joints.

Clove-Hitch Garter.—It is often found necessary to fix a patient's hands and feet out of the way during an operation, and this is very conveniently done by means of knitted "clove-hitch garters" passed round the wrists and ankles, and then tied to the legs of the table. These must always be tied in a reef-bow, *never in a knot*, as it may become necessary to release the limb very quickly at any moment, *e.g.* for the purpose of carrying on artificial respiration. These garters are closely knitted with ordinary strong wool, are about seven or eight feet long and about two inches broad. They have the advantage over ordinary cotton bandage, which is generally used, of being soft and slightly elastic, and so do not hurt the skin, and when put on as a clove-hitch they cannot possibly become tight enough to strangulate the limb. A "clove-hitch" is made by making two successive loops in the same direction and placing one behind the other (Fig. 41).

Side-Tables.—On these are placed the lotions, sponges, instruments, etc. Sometimes only one table is available, and everything must be kept on it; but, when possible, it is of advantage to have one on each side of the operating table, in order that the lotions, instruments, and sponges, —which are necessarily moist and likely to cause a mess, —may be kept away from the dry dressings and the anæsthetic tray. These side-tables should be about the same size as the operating table, and are conveniently placed about four feet from it.

In describing these we may speak of them as the "Lotion Table" and the "Dressings Table."

CHAPTER X.

THE LOTION TABLE.

THIS may be arranged to suit the tastes and convenience of the dresser or nurse whose duty it is to attend to it, but it is well to adopt some systematic arrangement, and to adhere to it, as by doing so the finding of anything asked for will be greatly facilitated. However arranged, on this table should be found—

A WINCHESTER JAR OF EACH OF THE FOLLOWING LOTIONS :- -

(1) Carbolic acid, 1 in 20.
(2) Carbolic acid, 1 in 40.
(3) Corrosive sublimate, 1 in 500.
(4) Corrosive sublimate, 1 in 1,000.
(5) Corrosive sublimate, 1 in 2,000.
(6) Boracic acid lotion, saturated.

In addition—

(7) Six or eight lotion basins.
(8) Two kidney-shaped basins.
(9) Two bleeding cups.
(10) Six or eight macintoshes (pink jaconette).
(11) Six or eight carbolised towels.
(12) Six or eight clean dry towels.
(13) A dozen sponges.
(14) A pail of hot water.
(15) A pail of cold water.
(16) A slop-pail.
(17) A dirty-dressing tray, placed under the table.
(18) A nailbrush.
(19) A bottle of spirit of turpentine.
(20) A quantity of powdered carbonate of soda.
(21) A jar containing drainage tubes.
(22) A small jar containing safety-pins in 1·20 carbolic.
(23) Jars containing ligatures and sutures—(*a*) cat-gut, (*b*) whale-gut, (*c*) kangaroo-tendon, (*d*) silk, (*e*) horse-hair, (*f*) silver wire.
(24) Lead buttons for button sutures.
(25) Tourniquets—(*a*) Petit's screw tourniquet, (*b*) Foulis' tourniquet, (*c*) Esmark's elastic webbing.
(26) Instrument tray and tray for artery forceps.
(27) Syringes—(*a*) Higginson's syringe, (*b*) glass syringe, (*c*) vulcanite syringe, (*d*) brass syringe.
(28) Box of sawdust, or large tray under operating table.

The Lotions.—Prepare (1) a basin of carbolic, 1 in 20, for purifying the skin of the patient, and for the surgeon's hands. In it should be placed a nail-brush and a swab of wool. (2) Two basins (enamelled) of corrosive lotion, 1 in

2000, or carbolic 1 in 40, for irrigating during operation, a swab of wool in each. These must be changed so soon as ever a brownish deposit appears in the lotion. (3) Two or more basins of carbolic for washing sponges, also to be frequently replenished. All the lotions should be diluted with tepid water. In preparing these it should always be made a rule to put the *lotion* into the basin first, so that should the other ingredient by any chance be forgotten, the error shall be on the side of antiseptic safety. I have already indicated the necessity of using enamelled basins for the corrosive lotion, and also the importance of purifying the edges of kidney and bleeding tins, before bringing them in contact with a wound.

The Carbolised Towels.—A number of these should be prepared with 1 in 20 lotion, and wrung out just as they are required. They cannot be made too dry. They should be handed up spread out on a macintosh, and should cover over the whole area of operation. A few spare towels and macintoshes should be kept ready to prepare if required. Towels sterilised by heat have certain advantages over carbolised towels, but their use has only been attended with partial success. They, of course, are suitable in an hospital where aseptic surgery is the rule, but this ideal is only reached in few places, and cannot be depended upon.

The Sponges.—Remove the sponges from the jar of 1 in 20 carbolic in which they are kept, and after squeezing them dry, place them in a purified solution tin, covered over with a dipped towel. During the operation they must be handed up to the surgeon as dry as they can possibly be made. If plunged at once into carbolic lotion, when received back from the operator saturated with blood, the albumen of the blood will be coagulated, and the small stringy masses of fibrine produced are only removed with great difficulty. To obviate this the blood should first be washed out in plain water, and the sponge subsequently passed through 1 in 40 and then 1 in 20 carbolic before being used again. One should be particularly careful never to hand up a sponge direct from the plain water, which is not antiseptic. Corrosive sublimate blackens sponges. Sponges should in-

variably be counted before operations in which a large cavity is opened, *e.g.* the abdominal or thoracic cavities, and the number in use written on a slip of paper, and on no account may a sponge be torn during the operation. Before the wound is closed, they should be counted again lest any be left inside. If a sponge fall on the floor, or into the sawdust box, it must be put aside altogether, and not permitted to be used again till it has been thoroughly purified. In cases in which the discharge is putrid, sponges should be discarded entirely, and swabs of wool used instead.

Cleansing of Sponges after Operation.—The sponges should be taken from the lotion as soon after the operation as possible, and all the blood and pus removed from them by repeated washing with hot water, until the latter remains unstained by blood. They are then transferred to a strong solution of carbonate of soda (washing soda), and left there for twenty-four hours, that all grease may be dissolved out of them. At the end of that time they are once more washed in clean water and replaced in 1 in 20 carbolic till again required. It is well to keep two complete sets of sponges, in order that a periodical purification can be carried on without interruption. The following directions for cleansing sponges, which have been in use for some time, are given by Caird and Cathcart in their *Surgical Handbook*:—(1) Free them from grease by steeping in a concentrated solution of washing soda; (2) then soak for twenty-four hours in permanganate of potash 1 gr. to 1 oz., and wash again in clean water; (3) soak in 1 per cent. solution of commercial salt of subsulphite of soda, with 8 per cent. pure concentrated hydrochloric acid (in 24 oz. of water, ℥i of the soda, and ℥ii of the acid) until (in about a quarter of an hour) they have become white; (4) again wash in water until scentless, and store in 5 per cent. (1·20) carbolic acid.

Preparation of Operation Sponges.—It may be convenient here to give some directions as to how sponges are made fit for use in surgical operations. Having secured Turkey sponges of the best quality, very close in texture, and about the size of a closed fist, they should be thoroughly washed

in hot water and then dried. They must then have all the sand and calcareous particles removed by pounding them with a mallet on a firm table to reduce the grits to a powder, and washing this out by alternately passing them through very hot and cold water till the latter remains quite clean. The beating should be carried on for half an hour at a time, and must be repeated till not a single gritty particle is to be found in the sponge. They are then placed in 1 in 20 carbolic, where they should remain for at least a fortnight before being used, the lotion being changed once or twice in that time.

To Prepare Sponges for Sponge-Grafting.—The finest sponge should be chosen. The calcareous particles are removed by steeping it in dilute nitro-hydrochloric acid, and any excess of acid is removed by means of a dilute solution of potash or ammonia. The sponge is then antisepticised by 1 in 20 carbolic, and is ready for use.

The nail-brush, turpentine, and soda are used for purifying the skin of the part to be operated upon. The carbolised towel, which is always applied for some hours before operation, softens the superficial epithelium, and by means of powdered soda and the nail-brush, this effete epithelium is softened and removed, and with it the manifold germs contained in it. This is followed by spirit of turpentine, which is a good solvent of fat and oil, in addition to being an antiseptic.

The Drainage Tubes.—The most commonly used material is india-rubber tubing perforated along its sides at intervals of about three quarters of an inch, the diameter of the hole being about a third of the circumference of the tube. Decalcified bone and strands of cat-gut have the advantage of being absorbable, and therefore not necessitating dressing of the wound for their removal. Glass and metal tubes have also been used. All drainage tubes should be kept immersed in 1 in 20 carbolic in glass jars, about six inches high and four inches in diameter, with close-fitting stoppers. A drainage tube must always be prevented from slipping into a wound by transfixing it with a sterilised safety pin (Fig. 8), a stock of which should be kept in carbolic for the purpose.

Ligatures and Sutures.—Ligatures are used to tie blood-vessels; sutures to stitch up wounds. Various materials are in general use for both purposes—silk, cat-gut, and kangaroo-tendon being chiefly used as ligatures; whale-gut, horse-hair, and silver wire as sutures.

(*a*) *Cat-gut* has the great advantage over some other forms of ligature of being absorbed by the tissues, so obviating the necessity of its removal by the surgeon, or by ulceration. It is made from the intestine of the sheep, which is first scraped so as to leave only the sub-mucous layer, and then dried and cut into strips of appropriate length and breadth. It is then antisepticised by means of chromic or carbolic acid, and kept either in carbolic and glycerine (1 in 10), or in eucalyptus, or some other essential oil. It is often not reliable as to its asepticity, but can be rendered so by being boiled in a 97 per cent. solution of absolute alcohol for one hour. It has been shown that cat-gut so treated may be kept in a putrescible fluid for weeks without putrefaction taking place. Cat-gut ligature should always be tested before being handed up to the surgeon to make sure that it will stand the strain put upon it in tying the vessel.

(*b*) *Whale-gut* has the same advantages as cat-gut, and is largely used as ligatures and sutures.

(*c*) *Kangaroo-tendon* is prepared from the strong tendon of the tail of that animal, and has the advantage of being very strong, and, as a rule, thoroughly reliable.

(*d*) *Silk* may be used for either ligatures or sutures provided it has been thoroughly antisepticised by being kept for at least twenty-four hours in strong carbolic before being used. Silk may be further purified by being boiled, or subjected to steam in a steriliser for half an hour, and then soaked in 1 in 20 carbolic till wanted. When perfectly aseptic, Lister has shown that it can be absorbed by the tissues, although the process is very slow. As a rule, it acts as a foreign body and ulcerates out in the discharges, hence, no more than is absolutely necessary should be left in the wound.

(*e*) *Horse-hair* is used for sutures in wounds where there is little tension, or where it is desirable that no scar

should be left by the stitches—for example, in face wounds. It is not readily absorbed, but is very easily and painlessly removed. Unfortunately, prolonged immersion in antiseptic fluids renders it very brittle, so that we have to rely chiefly on cleansing it just before it is required. Experience shows that this is usually quite sufficient.

(f) Silver Wire is employed in wounds where there is considerable tension on the edges, and usually in the form of *button sutures* (Fig. 10). The buttons, which are to prevent

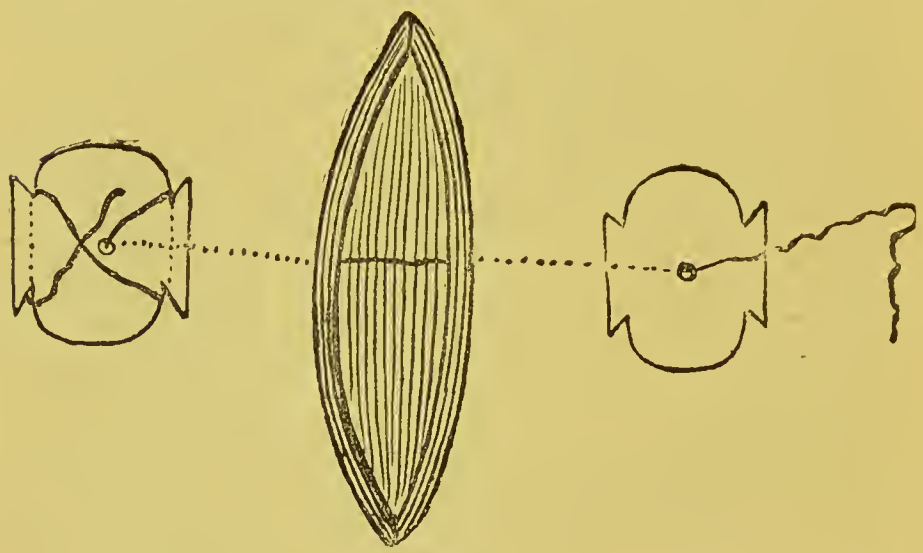


Fig. 10

the wire cutting out through the skin, are oval pieces of sheet lead, with projecting wings on each side, and a small hole in the centre. The wire having been passed through the skin with a stout "wire needle," each end is passed through the hole in a button, and one end having been fixed by being twisted round the wings, the edges are approximated, and then the other end of the wire is fixed in the same way. Usually the edges of the wound between the deep sutures are united by superficial sutures of horse-hair or cat-gut. The buttons are kept in carbolic.

Each of these materials should be kept in a jar similar to that used for the drainage tubes, containing 1 in 20 car-

bolic, except the horse-hair and silver wire, which may be kept dry.

Caution!—Before the operation is begun the stopper should be removed from each of the jars, and the edges washed with a swab of wool to remove the dust and its accompanying germs which have been landing on them since last used. If this precaution be neglected, when a ligature is being withdrawn it will collect all this dangerous matter and convey it to the wound. Too great care cannot be taken to prevent ligatures or sutures touching the clothes of the dresser or nurse, or of others standing around.

Needles.—These are of various sizes and shapes, some being straight, others curved (Fig. 64), half curved, and so on. Special needles are used for silver wire, having a groove running from the eye to the blunt end, in which the wire lies. Some needles have two eyes, the thread being passed through one and then through the other, thus guarding against its coming out.

Needles should be kept in a wide shallow glass tray, five or six inches in diameter and one and a half inch deep, with a metal lid, rather than in a pin-cushion. The advantages are (1) that they can be kept cleaner ; (2) they can be kept sharper ; and (3) they are less likely to be lost.

The needle must be securely threaded, and the suture tested before being given to the surgeon.

Tourniquets.(Figs. 68, 69, 70) are used to arrest or prevent hæmorrhage. Before applying a tourniquet the limb should be emptied of blood as thoroughly as possible. This may be done by simply elevating it for a few minutes, or better still, by applying Esmark's elastic webbing from the distal extremity towards the trunk, thus driving the blood out. This having been done the first turn of the tourniquet must be applied very quickly and firmly, so as at once to arrest all circulation through the limb. If this be not done it will only arrest the venous return, without interfering with the arterial supply, the result being engorgement rather than depletion of the part.

Hot and Cold Water, etc.—Under the table should be kept a large tin pail furnished with a close-fitting cover, and filled with hot water, with which to dilute and heat up the

various lotions. A supply of cold water will also be useful. In addition a large, wide-mouthed slop-pail should be ready into which dirty lotions, etc., may be emptied. Under the operating table a large, shallow tray, or a wide box containing sawdust, for dirty dressings, should be placed.

Syringes.—The uses and methods of employing the various forms of syringe have already been treated of.

CHAPTER XI.

DRESSINGS TABLE.

ON this table are two distinct sets of articles, which are under the care of different assistants ; one the dressings ; the other the requirements of the anæsthetist.

The *contents of the Operation Dressing Tray* differ very slightly, if at all, from those of the ward dressing tray already described. They are:—(1) a supply of plain lint; (2) boracic lint; (3) gutta-percha tissue; (4) oiled silk protective ; (5) carbolised gauze bandages ; (6) double cyanide bandages ; (7) domette bandages; (8) cotton bandages; (9) adhesive plaster; (10) four clove-hitch garters; (11) safety pins; (12) wool boxes, containing (*a*) corrosive wool, (*b*) wood wool.

ANÆSTHETICS.

Anæsthetic-Tray.—The contents of this will of course vary according to the anæsthetic employed. They should embrace :—(1) two bottles chloroform; (2) two bottles ether; (3) one bottle " A.C.E." mixture ; (4) chloroform drop-bottle ; (5) folded towel or inhaler ; (6) ether inhaler ; (7) small pot of vaseline for face ; (8) tongue forceps ; (9) clean towel ; (10) solution tin ; (11) hypodermic syringe charged with ether ; (12) several hypodermic syringes (uncharged) ; (13) bottle of eucalyptus oil for sterilising these ; (14) two minim glasses ; (15) supply of brandy ; (16) strong solution of ammonia ; (17) solutions of cocaine, 5 per cent., 10 per cent., 20 per cent.

The Anæsthetic.—Although it is seldom required of a nurse that she should be able to administer anæsthetics, it is only right that she should have a general idea of the action of these, the dangerous conditions arising during their administration, and, above all, the means to be adopted of

treating them. From the student of medicine no subject deserves more careful study than that under consideration. As every one knows, chloroform and ether, the most commonly employed anæsthetics, are given mainly to prevent the patient suffering pain, whether it be the pain of a surgical operation or of parturition. They are also given sometimes to overcome muscular action, *e.g.* in the reduction of dislocations in very strong men. No patient should have an anæsthetic administered to him, unless he has been properly "prepared" for it (p. 57), except, of course, in cases of accident where this is obviously impracticable.

CHLOROFORM.—There are three important points with which it is necessary to be well acquainted regarding the administration of this anæsthetic:—(1) its physiological action; (2) the proper method of administration; (3) the dangers likely to arise, and their treatment.

(1) *Physiological Action.*—Chloroform acts first by stimulating the nervous system, and later by depressing it; there is an early period during which the patient has delusions, struggles violently, and is hyperæsthetic, and then follows a period of stupor, with relaxation of muscles and blunting of the sensations. It must be borne in mind, moreover, that chloroform poisons the brain centres in a definite order, and that we only desire this process to go to a certain limit within which the patient is safe. The order is:—(1) Paralysis of voluntary motion; (2) paralysis of sensation; (3) paralysis of reflexes; these stages are to be attained; (4) paralysis of respiration; (5) paralysis of heart, which of course must be avoided. Sometimes accidents occur which apparently disarrange this regularity of action, but these are due to some intercurrent condition, and not to chloroform itself. Having attained the first three stages, it must be remembered that only a very little more is needed to reach the remaining two, and that the patient is in a very dangerous condition, and one which requires the anæsthetist's undivided attention. Chloroform, being a cumulative poison, should be administered with extreme caution, as the patient may have taken a good deal more than is indicated by his general condition.

Fortunately, however, it is also a volatile poison, so that, should the limit of safety have been overstepped, by carrying on artificial respiration for a sufficient time to enable the excess to volatilize, the respiratory and cardiac centres will resume their functions.

(2) *Method of Administration.*—The chloroformist has quite enough to do with his own work, and must on no account try to assist with anything else, or to see the operation. The patient, when thoroughly under, is at the brink of the grave, and a single step may place him beyond recall. Before beginning the administration, the patient should be made quite comfortable, lying on his back with a hard pillow under his head. He must have nothing in his mouth, such as false teeth, sweets, tobacco, etc. Everything about his neck and waist must be quite loose to facilitate respiration. Chloroform is a heavy vapour, and so falls on to the patient's face, irritating the skin, and to prevent this irritation, a thin layer of vaseline, or some such ointment should be smeared over the face. No special inhaler is necessary, a towel folded into a square and placed over the face being quite sufficient. Some surgeons, however, prefer a special apparatus. A simple inhaler is made of a small wire mask, over which is stretched a layer of thick flannel. Success in administering chloroform, however, depends, not on the apparatus used, but on the person using it. Were more attention given to the physiological action of chloroform, and less to the machinery by which it is administered, fewer calamities would disgrace the pages of medical literature. A few drops of chloroform are sprinkled over the surface of the towel, and the patient is asked to take long breaths. Children usually hold their breath and refuse to take the chloroform, and the best way to manage is to tell them to blow it away, or to get them to cry, when the resulting deep inspiration effects the desired end. Do not hurry the patient much at first, and should he feel inclined to choke, remove the towel for a second or two and give him a breath of fresh air. Chloroform is only safe when mixed with about equal parts of air. When the patient is struggling it is not advisable to resist him, as it only increases the trouble ; guide his movements, and the

struggling stage will be quickly passed. Patients who have been addicted to alcohol usually present exaggerated struggling phenomena, with sometimes tonic or clonic rigidity of the whole body lasting for a few seconds, and sometimes even epileptiform attacks. When once the struggling stage is passed in these cases it does not recur.

No one sign that the patient is under is infallible, and he must be tested in several ways to make sure: (*a*) *Muscular relaxation* indicates that he is at least partly under. This is tested by raising a limb and seeing whether or not it falls limp on being left unsupported.

(*b*) *Loss of local sensibility* may be tested by pinching or pricking the skin, *e.g.* at the seat of operation.

(*c*) *The abolition of the reflexes* is most conveniently tested by touching the conjunctiva of the eye, when, if no spasmodic closure takes place, the patient is presumably under. This is by no means a trustworthy guide, especially in children, and should be employed much less than it is. The constant touching of the conjunctiva so often practised by some anæsthetists is frequently followed by troublesome inflammation of the eye.

The patient once thoroughly under, the operation is begun, and the anæsthetist must devote his whole attention to his work. On the one hand the patient must not be allowed to come out, and on the other he must not be put too deeply under.

A vigilant watch must be kept on the general appearance of the face—the colour of the cheeks, lips, and ears. So long as the natural colour of the face persists, with red lips and ears, all is well; but excessive pallor or lividity are indications of approaching danger, which dare not be neglected.

The condition of the respiration is of the utmost importance. It is conveniently observed by placing the hand over the mouth and nose of the patient, when the rapidity and force of the respiration may be judged by the breath of hot air expelled at each expiration. This is a very delicate test, and slight variations are readily detected by a careful observer. Stertorous breathing is an indication of complete anæsthesia, although not of necessity a sign of

danger; but if the breathing become shallow and irregular, or gasping and sighing, too much chloroform has been given. The action of the pulse is to be observed, rather as an indication of the patients general condition, than of the effect of the chloroform.

(3) *Dangers and their Treatment.*—(*a*) *Difficulty in Respiration* may be due to some foreign body getting into the larynx, such as false teeth, a piece of tobacco, or some vomited matter from the stomach; or it may be due to the paralysed tongue falling back, and interfering with the entrance of air to the lungs. In the former case, the larynx should be explored with the finger, the patient's head being turned on one side to admit of anything falling into the cheek; in the latter the tongue should be seized with forceps and forcibly drawn out, thus opening up the glottis. The same result is obtained by turning the head on one side and pulling the chin forward, so that the lower teeth project in front of the upper ones. Sometimes the breathing is interfered with by the glottis closing through paralysis of the small muscles of the larynx itself. The symptoms of this condition are lividity and a peculiar crowing, croup-like sound. Pull forward the chin, seize the tongue with forceps, and withdraw it, so as to open the glottis.

(*b*) *Failure of the Heart* is usually due to reflex shock, the operation having been commenced before the patient is properly under, or when he is coming out, or to his having fainted from some other cause. To prevent this accident the patient may have some stimulant before the administration is commenced. On no account should a patient who is partially under chloroform ever be placed in the sitting posture. This is one of the most common causes of sudden death under chloroform. It is not death from chloroform, but rather from chloroformist. Should the patient faint, his head must at once be depressed by holding him up by the heels if possible. Raising the foot of the table is usually sufficient. Give a hypodermic syringeful of ether or brandy; apply strong ammonia to his nostrils; flip him with wet towels; and, if it be at hand, apply the constant

current. Never use an induced interrupted current which by stimulating the vagus nerve inhibits the heart.

(*c*) *Vomiting* is only dangerous in so far as it furnishes foreign bodies which are very apt to get into the air passages. The act itself also interferes to some extent with breathing, but it stimulates the heart. The administration must be discontinued if the patient has anything in his stomach to vomit, *i.e.* if he be not prepared for chloroform. If he be prepared, on the other hand, and his stomach be empty, the sooner he is under the sooner the reflex act will cease.

ETHER has long enjoyed a reputation over chloroform for safety. It is preferred by many on account of its stimulant action on the heart. It causes more struggling than chloroform, and in some patients the after-sickness and headache are more severe. In administering ether some form of inhaler is almost always used, as it is so very volatile that much is wasted with a towel. When given by the "open method," in which the ether is mixed with fresh air, Alli's inhaler is employed. This consists of a wire framework, on to which is threaded a length of flannel or domette bandage, and the whole is enclosed in an india-rubber case. By this method the patient takes a long time to go under, and struggles very much. By the "closed method," on the other and, the anæsthesia is rapidly and quietly produced, by causing the patient repeatedly to breathe and rebreathe the same air charged with a gradually increasing proportion of ether vapour. This is effected by means of Ormsby's or Clover's inhaler (Fig. 11). Ether is a highly inflammable vapour, and must never be allowed near a light.

"*A.C.E. Mixture*" consists of alcohol (absolute), one part; chloroform, two parts; ether, three parts. It has the combined advantages of ether and chloroform, the alcohol being added for pharmaceutical purposes. It should be freshly prepared, as the mixture decomposes readily.

Chloroform Drop Bottle consists of a small bottle furnished with an aperture which permits the contained fluid to escape in very small quantity. It is used to save chloroform, and to enable the administrator to judge better of the amount he is giving.

Tongue Forceps.—Ordinary artery catch forceps (Fig. 74) are used to pull forward the tongue should it fall back and interfere with the respiration, or should there be any other cause interfering with the free entrance of air to the lungs. They should always be at hand, and perhaps the most convenient place to carry them is attached to the collar of the coat or apron strap. In seizing a patient's tongue a good strong grip should be taken through the middle of the organ, to avoid tearing pieces out of the edges, as invariably happens if one attempt to take a narrow hold.

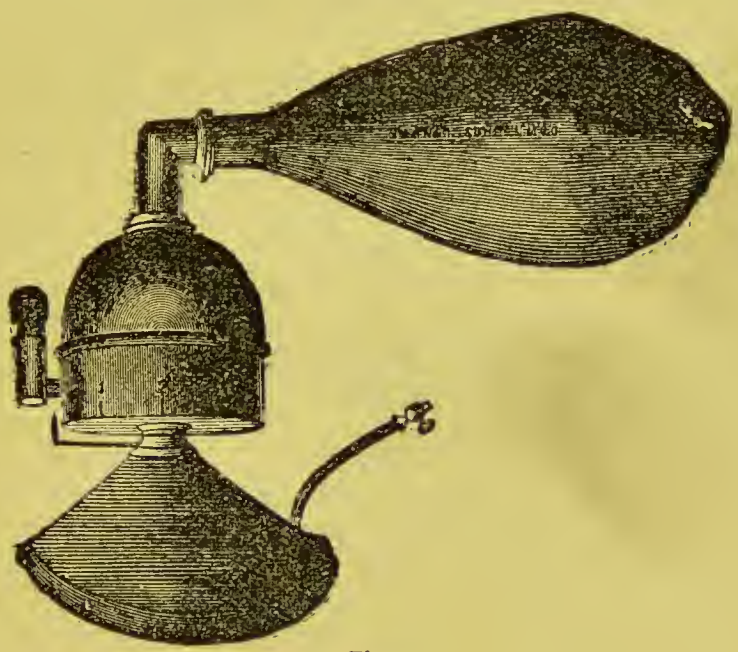


Fig. 11.

A clean towel and *solution tin* are kept ready in case of sickness, and should be within reach of the chloroformist.

Hypodermic Syringes.—There should always be several of these on the table. It is quite exceptional to find a hospital hypodermic syringe fit for use, and as there is almost no appliance which is wanted on such short notice, it is most important that it should be ready and in working order. A syringe may be wanted (1) to inject a solution of morphia and atropia before the operation, as this is supposed by some surgeons to render the administration of chloroform

safer by diminishing sickness, preventing reflex stoppage of the heart, and diminishing pain. (2) To inject ether subcutaneously should the patient faint or the heart's action become feeble. For this purpose a syringe should always be filled with ether before the operation is begun, and placed near the administrator.

To fill a hypodermic syringe, remove the wire stillete from the needle, pour a quantity of ether into a measuring-glass, fill the barrel of the syringe *without the needle*, then screw on the needle, expel air from the apparatus, and place the syringe, with the needle upwards, close beside a bottle of eucalyptus oil ready for use.

Cocaine is used as a local anæsthetic, the stronger solutions—10 per cent. and 20 per cent.—being painted on to mucous surfaces, such as the nose and throat; while the 5 per cent. solution is injected hypodermically before performing minor operations of short duration. About 5 minims should be injected, and this repeated once or twice if necessary, the needle left *in situ*, and unscrewed each time to avoid unnecessary pain in re-inserting it. Its use is sometimes attended with dangerous symptoms, hence it must be employed with caution.

CHAPTER XII.

PREPARATION OF PATIENT FOR OPERATION.

THIS includes (1) the preparation of the patient for the anæsthetic; and (2) the preparation of the part to be operated upon.

(1) *The Preparation of a Patient for Anæsthetics.*—In the case of a patient who is in the habit of leading an active life out-of-doors, it is always wise before subjecting him to a serious surgical operation to keep him in hospital for a few days, that he may get accustomed to his altered conditions and his new surroundings. The last day or two of this probation may be spent entirely in bed. He should at the same time be specially dieted, fish, chicken, milk-puddings, and similar light nourishing diet being indicated. Special attention must be paid to the excretory functions, notably the alimentary track. The bowels should move regularly and naturally, and if this does not occur spontaneously it must be secured by administering suitable medicines under the doctor's orders. On the evening immediately preceding the operation the patient should have a large dose of castor oil (say a tablespoonful and a half for an adult, or a dessert-spoonful for a child), and about four o'clock the next morning the night nurse will give a large enema of soap and water, to ensure complete evacuation of the bowels. Supposing the operating hour to be noon, about 6 a.m., a light breakfast consisting of a cup of tea and some plain dry toast may be given, but he should have *nothing* after this. In the case of children, and not unfrequently in adults, it is necessary to watch that food is not obtained surreptitiously, as it is difficult to persuade them that this prolonged fast is necessary.

In very old and feeble patients of course certain allow-

ances must be made. Carefully regulating the bowels by small doses of cascara for a few days will dispense with the necessity for a large purge, and a small plain enema in the morning will suffice. Such patients, too, may have beef tea, Valentine's juice, brandy, and similar fluid supports, but nothing solid. The necessity for these precautions being carried out to the letter will be evident after what has been said of the dangers of sickness and vomiting during anæsthesia.

(2) *The Preparation of the Part to be Operated on.*—On the evening before operation the skin, if unbroken, should be washed with soap and water to which some soda has been added, to dissolve the superficial epithelium, and to remove oil and grease. It is then covered over with a carbolised towel (1 in 20), kept moist by a layer of macintosh, which softens the superficial epithelium, and enables it and its contained germs to be easily removed before beginning the operation. It is often an advantage to shave the part before applying the carbolised towel, but in the case of nervous patients it may be left till after the anæsthetic has been administered.

Taking the Patient to and from the Theatre.—When available, a wheeled table is by far the best means of removing a patient from the ward to the operating theatre. As this also serves as an operating table, the patient can be quietly and comfortably arranged in the ward, so that as soon as he arrives in the theatre, the administration of the anæsthetic may be commenced, before ever he has had time to become alarmed by the preparations made for the operation. As a general rule it is not advisable to administer the anæsthetic in the ward or ante-room, before taking the patient into the theatre. In transit between the two places any accident, such as the patient fainting, or choking on vomited matter, may happen and escape notice, or, even if noticed, the requisite means of treatment may be unavailable, with the most serious results. When a stretcher has to be used, the patient should be carried as steadily as possible, the bearers "breaking the step," to avoid the uncomfortable swinging which results when they keep in step. Repeated shifting of the patient from one convey-

ance to another is undesirable in taking the patient back to bed, when he is in a partly unconscious condition, suffering from shock, and very probably has some wound which will be injured by moving. It is here that the wheeled table is particularly useful. Under no circumstances should a patient ever be propped up in the sitting posture immediately after an operation, because the weakened circulation may not be sufficiently strong to carry blood to the brain, the patient will faint, and even a more dreadful result may follow. This danger always exists in patients under anæsthetics, and one must be ever on one's guard. It is a common thing to see a semi-anæsthetised child lifted in a nurse's arms and carried from the theatre. If this be properly done it is quite a safe procedure, but in nine cases out of ten it is not. The child is seized with one arm around its neck, the other behind its knees. The head hangs over the arm which supports it, while the limp body doubles up and hangs between the two arms. In this position, although the head is hanging, it is by no means the most dependent part of the body, as it should be. The buttocks are the lowest parts, and the position is perhaps the very best that could be wished for to allow the blood to gravitate into the abdomen and pelvis, so depleting the brain and causing fainting. Alarming accidents are sometimes caused in this way, which may be obviated by taking care that the head is the most dependent part of the patient's body.

The Nurses' Duties towards Patients during Operation.—It is an invariable rule that a nurse should accompany every female patient to the theatre, and remain with her throughout the operation. It is comforting to the patient, and many of her fears are dispelled when she has by her a friendly nurse whom she has come to know and trust, rather than a host of strangers. The patient's dress should always be arranged, so far as is possible, before leaving the ward. For example, when the operation is in the region of the shoulder or chest, the bed-gown should be removed from these parts, and a blanket take its place till the operation is begun. In operations about the face and neck, especially in females, much discomfort is caused

to the patient, and no less trouble to the nurse, by the hair getting soiled and matted with blood and lotion. This is very easily obviated by covering the whole head with an india-rubber bathing cap, and this by a dipped towel. A female patient's hair should never be plaited and then coiled on the back of her head, because it becomes very painful when she has to lie for a long time resting on it. Other arrangements of the dress or coverings of patients to prevent chilling or undue exposure are obvious. When the patient is weak and collapsed, or very old, hot bottles should be placed on the table, care being taken that they do not interfere with the surgeon, and that they are not likely to fall off the table. A good plan is to have the central part of the cushion on the operating table replaced by a tin tank filled with warm water, and covered by three or four layers of blanket *securely fixed* in position.

While the operation is going on, the patient's bed should be prepared for him, fresh sheets, blankets, and pillow-cases thoroughly aired being put on it. Next the mattress an ordinary sheet is placed, and over this, a large, thick macintosh, and then the draw-sheet, on which the patient is laid. For the first few hours after coming from the theatre he should have a blanket next him. This may be removed and replaced by a sheet when the shock has passed off. Outside this, one or two blankets and a cover make up the complement of bed-clothes. Before the patient is put into bed it should be thoroughly warmed by means of several hot bottles placed under the blankets.

CHAPTER XIII.

TREATMENT AFTER OPERATION.

On the return of the patient to the ward, the blankets and hot bottles are removed from the bed. As gently, and with as little disturbance as possible, he is lifted on to the bed, and the blankets and bottles replaced at once, care being taken that a layer of blanket always intervenes between the bottle and the skin, lest he be burned, and, on account of his semi-anæsthetic condition, give no sign. If necessary, a cage is put over the wounded part, to remove the weight of the bed-clothes from it. Only one pillow should be put under the head at first, and blocks should be ready on which to raise the foot of the bed should signs of syncope be given.

Chloroform Sickness.—On no account may the nurse leave the patient, even for a moment, till he is thoroughly out of the chloroform. In the less serious surgical operations in which the patient does not suffer much from shock, as a rule the most troublesome immediate after-effect is chloroform sickness. Patients vary very much in the amount of suffering this causes them, as well as in the benefit they derive from the various methods of treatment. A good general rule is to allow the patient no food or drink for about four hours after regaining consciousness. Should he remain free from sickness during this time, he may have small pieces of ice to quench the thirst of which he will most loudly complain. This may be followed by iced milk, potash, or Valentine's meat juices. If the sickness persist and be severe, starvation must first be tried as a means of treating it, and should this fail the following may be tried in succession : (1) sucking small pieces of ice ; (2) sipping very hot water ; (3) hot fomentations applied

over the region of the stomach, and (4) mustard and linseed poultice in the same place. The administration of such substances as bismuth, dilute hydrocyanic acid, etc., usually given to allay vomiting, are, as a rule, of no use in this condition. Morphia and cocaine given internally are, however, sometimes useful. They must never be given, of course, except by order of the doctor. In some cases the sickness yields to none of these means, and the continuous vomiting prevents the nutrition of the patient, and may even prove fatal. In such cases every effort must be made to avert this calamity, and one means of feeding the patient is by *nutrient enemata.* The rectum having been washed out with a small enema of hot water or boracic lotion, a small nutrient enema may be given. It must not exceed two ounces in quantity, or it will not be retained. A good recipe is—Take of brandy, one and a half tablespoonful; Valentine, one dessertspoonful; warm water, one tablespoonful. This may be repeated in two hours, if necessary. It is often necessary to give some more direct cardiac stimulant than the brandy, when five or six minims of tincture of strophanthus added to the enema seems to act very well. Ordinary beef tea is not absorbed by the rectal mucous membrane, and should therefore not be given as a nutrient enema. The thirst in these cases of persistent sickness is often alleviated by about two ounces of warm water thrown into the rectum.

Other Dangers arising after Operation.—Further precautions must be taken, depending on the nature of the operation and the condition of the patient after it. For instance, in cases of severe railway smash where limbs have been amputated, there is considerable danger of *reactionary hæmorrhage*, by which is meant bleeding from a wound within the first few hours after operation—during the period of reaction. It may be due to a ligature slipping, or to some paralysed vessel which has not been tied, regaining its tone after the patient begins to recover from the shock of the operation. In these days of anæsthetics and bloodless surgery this form of hæmorrhage is fortunately less common than it used to be when speed in operating was the great desideratum, but it does occur

every now and again, and it must be most carefully watched for. In any case in which it is more than usually likely to occur, it is the doctor's duty to place a tourniquet in position, ready for the nurse to screw up tight should occasion arise; but if this be not done, then the nurse must rely on her knowledge of anatomy and surgical principles to compress the main artery above. That a hæmorrhage may not be allowed to go on for a time unobserved, stumps should be left uncovered by bed-clothes, and the nurse should frequently examine the dressing, especially at its most dependent part, where the blood will first show itself. Red bed-jackets or gowns should never be worn by operation cases, as hæmorrhage on to them may remain unobserved. In most cases, however, it is for serous or purulent discharge rather than for blood that a look-out must be kept, and this is scarcely less important. Should either blood or discharge penetrate the dressing, the house-surgeon must be summoned and the wound dressed at once.

Pulse and Temperature.—The patient's pulse and temperature should be taken as soon as he has recovered from the effects of anæsthetic, and marked on the chart with a note, "after operation," as these observations form a point of comparison with others to be subsequently made.

Subsequent Dressing after Operation.—An important question arises in the after-treatment of almost every operation. How soon and how often is it necessary to dress a wound? The less it is touched the better. The aim of antiseptic surgery is towards no dressing at all, that is to say, healing under the original dressing applied at the operation. Unfortunately we have not yet reached the stage when this is possible in all cases, although it is often attained, and we must now consider the points which are to guide us in deciding as to whether or not we shall dress a particular case.

(1) A wound must at once be dressed *if the discharge has come through the dressing*. This is necessary because of the danger of septic mischief reaching the wound by way of the discharge. The nurse should endeavour to anticipate the discharge reaching the surface, frequently

examining the most dependent part of the dressing, by folding aside a few layers of the bandage. Should she find that it is within a short distance of the surface, a large pad of antiseptic wool, dusted over with iodoform, should be at once placed over the area, till preparations have been made for redressing the whole wound. This pad is only a temporary protection, and is not to take the place of a fresh dressing, as the organisms may have already gained access to the discharge and will be *en route* for the wound.

(2) Even when "nothing is through," as the phrase goes, *if the patient complain of much pain* in the part, the wound should be dressed. The discharge may not be getting away, a drainage tube may have become blocked, a stitch may be too tight, and so on, and it is only by re-dressing that one can either find the cause of the pain, or relieve it.

(3) If there be *a disagreeable odour* from the dressing, it is safer to dress than to leave the wound.

(4) When *drainage tubes* are employed, it is necessary to dress the wound after a few days to remove or shorten them, even should everything be going well.

(5) If on the second or third day after operation the patient's temperature rushes up to 102° or 103° F., and no general condition explains the rise, it will be well to dress, as the probability is that the wound has gone septic, and if so the sooner it is dressed the better. Of course, an unexplained rise of temperature at a later date should be investigated in the same way.

Causes of Rise of Temperature after Operations.—One of the reasons mentioned for dressing a wound after operation was "an unexplained rise of temperature." This leads us to consider the more common causes of elevation of temperature within the first few days of operation.

(1) We are never alarmed if a patient's temperature goes up a degree or two on the evening of operation, as experience shows that such a rise is very common, without being an indication of any serious condition, and that the temperature soon falls again.

(2) There is no commoner cause of a sudden rise of temperature in surgical patients than *constipation*, and one

should always inquire into the state of the bowels before going further afield for an explanation. Should there be reason to suspect this as the cause, a free purge of castor oil or Henry's solution, supplemented by a large enema of soap and water, will often settle the point. If the free evacuation does not bring down the temperature, some other explanation must be found.

(3) *Tension* is another very common cause of elevation of temperature. A tight stitch, a blocked drainage tube, bagging of pus, the caking of discharge in a deep dressing, or any other condition preventing the free escape of discharge, and causing absorption of ptomaines, very soon manifests itself by raising the temperature. Obviously the best way to treat such a case is to dress the wound and remove the obstruction.

(4) Related probably to tension is the rise of temperature which one sometimes observes in cases where cavities have been stuffed with iodoform gauze or other *stuffing*, and in which the removal of the stuffing is usually followed by a fall in the temperature.

(5) The onset of *sepsis*, or of any of the septic diseases, such as erysipelas, septicæmia, etc., is usually ushered in by a sudden rise of temperature among other things.

(6) The high temperature may be due to *some condition quite apart from the patient's surgical affection*, such as a chill, the onset of a bronchitis or pneumonia, or some such medical affection. The history and general condition of the patient, taken together with the physical examination of the chest or other region indicated, will be sufficient to decide the point. Allied to this set of cases is the rise and fall of temperature so common in tubercular patients, whether the surgical affection be of that nature or not.

(7) *Excitement* of any kind is a not uncommon cause of elevated temperature in neurotic patients; for example, the receipt of bad news, the visit of a friend, the admission to the ward of a serious accident, or a death in the ward may temporarily raise the temperature in some patients.

CHAPTER XIV.

NURSING OF SPECIAL CASES AFTER OPERATION.

In certain serious operations much of the success depends on the after treatment, and especially on that part of it which devolves on the nurse. In some of those special training is necessary, and in all of them experience in nursing ordinary cases is absolutely essential in one who is to take care of the subjects of them. An elementary knowledge of the condition for which the operation was performed assists the nurse greatly in intelligently performing her duties.

Of those affections requiring especial care in the after treatment, hernia may be instanced.

(1) *Hernia.*—(*a*) *Strangulated Hernia.*—In the condition of hernia or rupture, a small portion of the bowel has escaped from the abdominal cavity through some weak point in the walls. The commonest localities in which such projections take place are the groin and the navel. The canals or openings through which these knuckles of bowel come, are usually bounded by firm fibrous bands, and the gut is in constant danger of being nipped between these, giving rise to the condition of strangulated hernia. When this occurs, the onward passage of the fæces is, of course, arrested. In addition, the blood supply to the portion of bowel outside the constricting band is cut off, and this produces gangrene or death of it, with the result that the contents of the alimentary track escape into the abdominal cavity, giving rise to septic inflammation of the peritoneum or membrane lining the abdomen. If it be borne in mind that in strangulated hernia the bowel is as soft as a piece

of wet blotting paper, it will readily be understood that the patient's life is in imminent danger, and will show the importance of attending to some of the directions for the treatment given by the surgeon. The main indication in the treatment is to secure for this devitalised portion of intestine absolute rest. Now, as the work of the bowel is to absorb the digested food, and pass on the unabsorbable remains, the surest way of keeping it at rest, is to starve the patient, so that there will be nothing either to absorb or pass on. The bowel may be still further quieted by the administration of opium, either hypodermically or by the mouth; but this, of course, will be done by the doctor. For the first day or two after the operation, the patient must have nothing by the mouth save sips of water or small pieces of ice to suck; then a small quantity of milk may be given, and later still, some light pudding and beef tea. Avoid anything solid for at least a week, and, above all, do not give any laxative medicine whatever. If the patient be well at the end of eight or nine days, an enema followed by a moderate dose of castor oil, may be given if the bowels have not already acted spontaneously.

(*b*) *Radical Cure of Hernia.*—The treatment of a patient who has undergone this operation differs from that which we have just considered only in the duration of the period of starvation. This depends on the fact that here the bowel itself is uninjured, the operation consisting merely in closing up the opening through which the hernia protrudes, with the object of preventing the patient ever having a strangulated hernia. The bowel must be kept at rest for a time to avoid the necessity for straining, which might burst open the wound in the skin and abdominal walls; but this, although stringent at first, need not be so prolonged as in the more grave condition last described.

Ovarian and Uterine Operations.—These cases usually come under the care of special surgeons, and of nurses trained for the work. One or two points, however, may be mentioned regarding them. The main indications in the after treatment are to give the bowel absolute rest, to avoid sickness and vomiting, which may cause the wound in the

abdominal wall to burst open ; and, above all, to insure the most perfect asepsis. To ensure the first two objects the patient must be kept on very low diet for the first few days. After being put back to bed, she should have nothing for the rest of that, and all the following day, save a few sips of tepid water, to allay her thirst. Should there be sickness the water may be given cold. No food is given till the patient has passed flatus, and at first she has it in very small quantities at short intervals. At the end of forty-eight hours of this regimen, the diet may be gradually increased, milk and potash, Valentine's beef-juice, chicken tea, light puddings, etc., being in turn given. The bladder has, in some cases, to be emptied by the use of the catheter, which must be previously sterilised with the utmost care ; but the patient should be encouraged to make water without artificial aid if possible. At the end of a week, should the bowels remain closed, a gentle purge aided by an enema may be given. The stitches in the abdominal wound are usually taken out at the end of a week, and a dose of castor oil should be administered, and the patient's linen changed the night before to prevent the necessity for undue movements soon after the removal of the stitches. Morphia is only to be used in the treatment of these cases when absolutely indispensable.

Tracheotomy.—This operation of opening the trachea or wind-pipe, and inserting into it a tube through which the patient breathes, is usually performed in children for croup or diphtheria, although it is sometimes required for other conditions. The success of the proceeding depends as much on the after treatment as on the performance of the operation itself. After the operation the patient is put into a bed surrounded by a tent, readily extemporised by screens and blankets, and the air in this is kept moist by one or two bronchitis kettles placed beside it. The temperature inside the tent should be about 70 deg. Fahr., and draughts are to be studiously avoided. The child must be fed frequently and regularly with stimulant food, such as brandy, Valentine's meat juice, etc.; and should the heart show signs of failing, strophanthus or digitalis may be added. The keeping of the tracheotomy tube clear is the most im-

portant part of the nurse's duty. The tube usually made of silver, is double, the outer one being tied into the trachea, while the inner one is loose inside of it, that it may be removed and cleaned; or should it get blocked, the patient can cough it out, and so breathe through the outer one alone. At first the inner tube should be removed very frequently, say every twenty minutes, and washed in carbolic lotion, the lumen being conveniently cleared with a feather. A solution of bicarbonate of soda (baking soda), in water, is useful for cleansing the tube. At the same time the outer tube should be cleaned with the aid of soda solution and a feather, without being removed. The excess of carbolic lotion should be dried off and the tube lubricated with glycerine before being reintroduced. One or two layers of gauze spread over the mouth of the tube filters the air and prevents the inhalation of dust, etc. The tube is left in as long as it is required, a point which will be settled by the surgeon.

Caution!—The nurse must take every precaution against being herself infected with the disease from which the patient is suffering. To this end she must avoid unnecessary handling of the child, especially kissing it, and above all, should never get into direct line with its breath when coughing. She should frequently gargle her throat with Condy's fluid, or some such antiseptic, and, of course, should never take food in the patient's room. There is one great danger peculiar to cases of diphtheria of which warning must be given, and that is, sucking the tracheotomy tube. When this gets blocked, and all attempts with the feather fail to clear it, the temptation to relieve the great distress of the patient by sucking the tube is very great. Such a procedure, however, is quite irrational and highly perilous. A false membrane is blocking the air passages, and diminishing the amount of oxygen getting into the lungs to aerate the blood—in other words, the patient's distress is due to the small amount of air in his lungs. The effect of sucking the tube is, first, to withdraw the remaining air from the patient, and if the sucking power is sufficiently strong, some of the obstructing matter may be withdrawn. As a rule, however, it is not, and the patient is left worse

than he was found ; not only so, but the nurse has run an enormous risk, a risk almost amounting to a certainty, of being herself infected. Not a few valuable lives, both of nurses and surgeons, have been lost in this way, and although the devotion to the interest of the patient which prompted the action is much to be commended, the foolhardiness of it is certainly not to be emulated.

Operations on the Mouth and Jaws, e.g. Excision of the Tongue or of the Upper and Lower Jaws.—The principal duties of the nurse in cases of this nature are—(1) *The feeding of the patient*, as much of the success of the operation depends on his being able to take a sufficient amount of nourishment to carry him over the early days. As his power of masticating is gone, and of swallowing much impaired, it is usually necessary to administer his food partially digested through a stomach tube, passed either through the mouth or nose.

In *passing the stomach tube* (Fig. 122) the patient is directed to hold his head well back, and to open his mouth wide. The forefinger of the left hand is passed far back into the pharynx to guide the tube, previously lubricated with glycerine, past the epiglottis. When the end of the tube has reached the back of the mouth, the patient is asked to swallow it, and as he does so, it is gently pushed on, the head at the same time being brought into its natural position again. Care must be taken before introducing any food that the tube is not in the larynx or trachea. When it is so, in addition to the coughing of the patient, the sound of the air passing through the apparatus is sufficient indication of the fact. The patient is fed with peptonised milk, Valentine's meat juice, switched eggs, brandy, and so on ; if necessary, supplemented with nutrient enemata.

(2) *The mouth must be kept as clean and aseptic* as possible, by frequently washing it out with Condy's fluid or boracic lotion. This may be done by a small sponge *securely* fixed to a wooden handle, or held in long forceps ; or, better still, by a syphon arrangement (Fig. 181) fixed over the patient's head, so that a stream of lotion may be allowed to run in at one angle of the mouth, and out at the other.

Keeping the mouth sweet is of great importance, for several reasons: (*a*) it is very comforting to the patient; (*b*) it diminishes the risk of septic absorption and consequent septicæmia, and (*c*) it diminishes the risk of septic pneumonia, a very frequent cause of death in these cases.

(3) When the lower jaw has been excised, *the tongue* looses its anterior attachments, and *is liable to fall into the back of the mouth* and block the air passages. Should this occur, the head must be turned on one side, or even face downwards, to permit of the tongue falling forward again. If this be not sufficient, it is seized with catch forceps and forcibly pulled forward.

(4) Reactionary or secondary *hæmorrhage* is a source of danger in tongue cases. The nurse must be prepared to pass her finger well back into the mouth, and to press on the bleeding point, while someone else goes for the doctor.

Excisions of Joints.—The after treatment of cases of excision of joints depends on whether ankylosis or free movement is aimed at. If the former, then the parts are kept at absolute rest in a rigid apparatus till the desired end is obtained; but if the latter, *passive movement* must be carried out systematically from a very early stage in the case. After *excision of the wrist, e.g.*, passive movement of the fingers is commenced on the second day, whether inflammation has subsided or not, and continued daily. Care is taken to avoid disturbing the wrist while doing this by fixing the metacarpal bones. The other movements at the wrist joint are gradually encouraged as the new joint acquires firmness.

In the case of the *elbow* joint the passive movement of the fingers and wrist should be begun on the second day; and of the elbow itself about the tenth day, the position in which the limb is afterwards bandaged being varied from day to day. After a time the patient is encouraged to use the joint with care, and to compel this in children it is often necessary to confine the sound arm in a bandage.

So in the *shoulder* joint the fingers, wrist, and elbow are

exercised from the very first, and at the end of a fortnight the shoulder is gently moved. Various appliances must be extemporised to induce patients to use their joints after excision, due care being taken that the movements do not take place at joints other than those which it is desired to exercise.

After *fractures*, especially those implicating joints, passive movement is necessary to ensure a useful limb, and must be carried on on the same principles as after excision.

Ligature of Arteries.—Large arteries are frequently ligatured in their continuity for various diseases, notably for aneurism; and one or two precautions are specially necessary in the after treatment. (1) Most scrupulous antiseptic precautions. (2) The limb, slightly flexed, should be raised to favour the return flow of the venous blood. (3) The *temperature* should be kept up by enveloping the limb in cotton wool, and domette bandages, taking great care that no constriction takes place. In addition to this, hot water bottles may be placed near the limb, but the temperature of the water must not exceed 100° F., lest gangrene be induced, owing to the enfeebled condition of the circulation. (4) Absolute and prolonged rest is essential to permit of organisation of the clot in the aneurism and at the seat of the ligature.

The complications and risks to be guarded against are: (1) secondary hæmorrhage, which is usually due to sepsis, and therefore preventable; (2) gangrene of the limb beyond the ligature; and (3) inflammation and suppuration in the sac of the aneurism.

Method of Compressing the Chief Arteries.—One or two hints as to the control of hæmorrhage by digital compression may not be out of place here. This is usually called for in cases of emergency, and as there is nothing so alarming as a sudden and profuse hæmorrhage it demands no small amount of presence of mind and coolness on the part of the nurse. In selecting the point for applying pressure it is

essential that the vessel should be lying over and close to a bone which will furnish the necessary resistance.

The principal vessels in which this can be done are: (1) the *femoral* or chief artery of the thigh, to compress which pressure should be made in a direction slightly upwards and backwards, over a point in the middle of the front of the thigh high up in the groin (Fig. 12). Here the vessel is pressed against the brim of the pelvis.

Fig. 12. *After Esmarch.*)

This artery may be compressed as far down as the lower third of the thigh by pressing it outwards and backwards against the femur, but on account of the muscularity of the limb here, it is less satisfactory than pressure in the groin.

It is very difficult to control hæmorrhage by pressure

lower in the leg than this, on account of the depth of the vessels and their free communications with one another.

In the upper extremity pressure on the *subclavian* artery effectually stops all circulation through the limb. The artery is controlled by pressing the thumb deeply into the middle of the hollow above the clavical or collar bone, when the vessel is pushed against the first rib (Fig. 13). In compressing a patients *left* subclavian, stand on his left side and use your *right* hand, and *vice versa* for the other side.

Fig. 13. (*After Esmarch.*)

Fig. 14.

To control the *axillary*, or *brachial* arteries in the upper arm, pressure is directed outwards and backwards so as to get the vessel between the fingers and the humerus (Fig. 14). Lower in the arm digital compression is ineffectual.

The *common carotid* artery, which supplies the head with blood, may be controlled in the neck by pressing inwards and backwards between the larynx and the internal edge of the sterno-mastoid muscle against the vertebral column.

Bleeding from the scalp may be checked by pressure over the *temporal* artery in front of the ear; and from the face by compression of the *facial* as it crosses the lower jaw about an inch in front of the angle. The vessels which supply the lips are best controlled by grasping the whole substance of the cheek between the finger and thumb at the angle of the mouth.

SECTION II.—THE USE OF REST IN SURGERY.

CHAPTER XV.

EXTENSION APPARATUS.

"THE first and great requisite for the restoration of injured parts is rest." This was the dictum of John Hunter, and surgeons have all come to acknowledge its wisdom, and to act on it. Periodic rest is a physiological condition, and at regularly recurring intervals, the tissues of the body are recuperated by the cessation of their respective functions. As used in surgery, the word rest means something more than simply a state of physical repose, and implies the absolute abrogation of function for the time being in the tissue or organ. For instance, to give surgical rest to a joint, it must be rendered quite immovable; to rest a muscle, the joints on which it acts must be made rigid; to rest the eye, light must be entirely excluded from it; or to rest the stomach and small intestines, all nutriment must be administered through other channels than that of the mouth.

The great importance of rest in the treatment of surgical affections, especially such common conditions as strumous disease of joints, diseases of the spinal column, and fractured bones, was insisted upon by John Hilton in his classic work on "Rest and Pain," and the teaching of this great surgeon predominates the practice of to-day.

Very various are the methods employed to this end—bandages, soft and rigid; splints of wood, poroplastic

gutta-percha, etc.; the application of weights to prevent the movement of limbs, and so on. The most careful watching is necessary when these different appliances are being used, because in spite of the most cunningly devised apparatus, patients often continue to move injured and diseased parts, and so time is wasted and labour lost. Children are especially ingenious in defeating attempts made to fix the limbs and spinal column.

EXTENSION APPARATUS.—*Uses.*—Extension may be applied to the lower limb in almost any condition in which it is necessary to keep that part at rest. Most frequently it is used in strumous disease of the hip-joint, but very often also in the same condition of the knee. In such affections also as abscess of the thigh, psoas abscess, spinal disease or injury, and so on, this means of keeping the limb at rest is found very efficient. Many surgeons use extension with or without splints, in the treatment of fractures of the femur and bones of the leg. It is especially useful in children, in whom the long splint, which was the older method, is so apt to get wet and soiled. The necessary cleaning of the child interferes very much with the older apparatus, and so prevents the maintenance of that absolute rest so necessary in the treatment of such cases.

Materials Required.—(1) A quantity of strong moleskin or holland adhesive plaster; (2) a quantity of strong broad tape; (3) a number of boracic lint bandages; (4) an ordinary domette bandage; (5) scissors; (6) strong needle and thread, and tape measure; (7) safety pins; (8) a square piece of wood with a hole in the middle, and leather strap with buckle fixed to each side; (9) apparatus to fix on foot of bed; (10) weights attached to rope; (11) blocks to raise foot of bed; (12) cage; (13) means of heating plaster.

Method of Preparing the Materials.—The Plaster.—Perhaps the best way to begin the preparation of the plaster is by making a paper shape of it first, and then cutting the plaster from this pattern. Measure from the middle of the thigh to the sole of the foot. This is the length of the plaster. The breadth is about half the circumference of the limb, which is, of course, greater above than

below, and the plaster must therefore be shaped accordingly. At the level of the upper end of the malleolus or ankle-bone the plaster should be cut (or folded) so as just to equal the width of the tape used (Fig. 15, *a*). At the upper end divide the plaster longitudinally into three tails, each about 2½ to 3 inches long *(b)*. All along the edge of the plaster make a series of short cuts with the scissors *(c)*. These permit of closer apposition of the plaster with the leg. Two such pieces of plaster are necessary, one for each side of the limb.

Fig. 15.

The Tape.—This should be strong twilled tape *(d)*, about one inch wide and one and a half foot long, and is firmly sewed to the narrow lower end of the plaster, the two being attached for about an inch of their length.

The Boracic Bandage should be long enough to cover in the whole limb from the toes up to the middle of the thigh, and of the appropriate breadth for the limb to which it is to be applied.

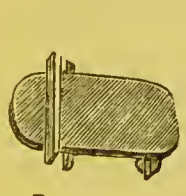
Method of Applying the Extension Apparatus.—The plaster may be applied next the skin of the limb, but as this is rather uncomfortable for the patient, and causes considerable pain by pulling on the hairs when being removed, it is better to apply it outside of the boracic lint bandage. We shall, however, describe both methods.

(1) *Next the Skin.*—The limb having been thoroughly washed with soap and water, the hairs should be shaved off, to avoid unnecessary pain when the plaster comes to be removed. Apply a few turns of domette bandage round the foot and ankle, to prevent pressure of the tapes on the malleoli. Next heat the plaster by applying its non-adhesive surface to the side of a vessel containing hot water, or by other means. In warm weather the heat of the body is quite sufficient. Apply the plaster

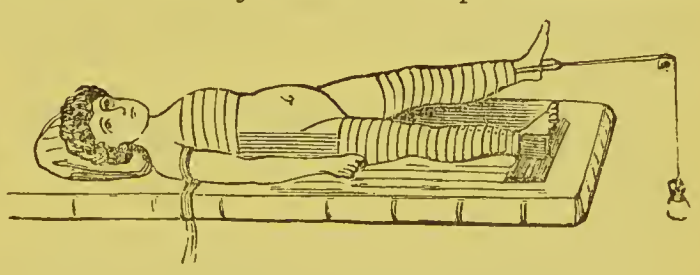
to the surface of the skin so that it adheres evenly, from the upper edge of the patella or knee-pan, to the upper level of the malleoli. By folding the nicks you have made along the edge, you will get very accurate apposition. The three tails at the upper end are not to adhere to the skin. Now apply a domette bandage from the toes upwards as far as the plaster goes, leaving out the tapes at the lower end. When you reach the three tails at the upper end, fold down the middle one so that it lies on the bandage, bring round another turn, covering in this tail, then fold down the remaining two, and cover them with another turn of bandage. By this means the plaster is not only adherent to the limb, but also to the bandage, which increases its security. Lastly, fix the bandage by a safety pin inserted in the long axis of the bandage.

(2) *On the Top of a Bandage.*—The advantages of this method are that the apparatus is more comfortable for the patient; there is no pain in removing it, and the limb is left clean and comfortable. It is advisable to use boracic lint bandages next the skin, because they are non-irritating, and at the same time are toxic to fleas, etc., which is often important. It is essential that the bandage be carefully and accurately applied, else the plaster is apt to drag it down when the weights are attached. The plaster is applied just as in the last case, leaving the tails free above, and avoiding the malleoli below; and covered over by a domette bandage with the same precautions, and dealing with the "tails" in the same way as before. The plaster is allowed to get fixed for a few hours before adding the weights.

Apparatus to Fix on Foot of Bed.—Perhaps the most con-



Pulley for Extension to Fix to Cot.



Extension applied in the Axis of the Diseased Limb.

venient form of apparatus for this purpose consists of a

framework which is hooked on to the foot of the bed. Through the flat board which forms the top of this a short piece of wood is passed. This is surmounted by a pulley, and can be raised or lowered to suit the height of the bed to which it is applied. The rope is passed through this pulley, and then through the hole in the centre of the small square piece of wood to which the leather straps are attached. The tape on the plaster is then fixed to these straps, and the appropriate weights attached to the rope. A simpler apparatus may easily be extemporised by lashing two strong uprights to the foot of the bed or crib, and using an empty cotton reel suspended between them on a stout piece of wire or wood as a pulley.

The Weights.—These may be either ordinary weights used in commerce, or masses of lead or iron, each weighing a half to one pound, and with a hole in the middle for attaching them to the rope. Bags of sand or leaden shot of known weight may be used when others are not available. The plaster should always be allowed to fix for an hour or two before the weights are attached, otherwise it is very apt to be dragged off. A light weight should be put on at first, and gradually increased, as by this means the muscles are not unduly fatigued at once. For a child of six years begin with 2 lb., and go up to about 3 lb. or 4 lb. ; for an adult, begin with 4 lb. or 5 lb., and go up to 8 lb. or 10 lb.

Raise the Foot of the Bed.—The object of this is to use the weight of the patient's body as a counter-extending force, so that the weights attached to the limbs will not tend to pull the patient to the foot of the bed rather than to pull on the limb, and so retain the diseased joint at rest. In hospital, suitable blocks are always available for this purpose; but in private, one or two bricks or blocks of wood will serve equally well.

Cage.—After all is fixed, a cage should be put on *over the rope and tapes* to protect them from the pressure of the bedclothes, which, of course, would prevent the proper traction of the weights.

After-Treatment.—As a rule, the comfort resulting to the patient from the apparatus makes him lie quiet, as only when he does so is he free from pain. In the early stages

of joint disease, however, when the patient has not much pain, he may be restless and attempt to move about. A long splint, applied from the axilla to beyond the foot on the *sound* side, will usually keep a child at rest; or, if necessary, he may be tied down by means of a sheet passed over his chest and secured to the sides of the bed. In all cases in which the leg is bandaged up, the toes should be left exposed, and should be examined periodically to make sure that no part of the apparatus is interfering with the circulation of the limb. Should the toes get cold or blue, or show any other evidence of obstruction to the circulation, the cause must be sought for, found, and rectified at once.

CHAPTER XVI.

PLASTER AND STARCH CASES.

PLASTER OF PARIS CASE.—*Uses.*—In chronic diseases of joints—*e.g.*, strumous disease, or chronic synovitis, rest of the diseased part is often obtained by enclosing the limb in a case of plaster of Paris, either with or without a Scott's dressing. In the treatment of fractures of the bones of the leg also, a plaster case is often found useful, as it enables the patient to be up and about, with the aid of crutches, much earlier than would be possible with any less rigid form of apparatus. In fractures, however, it should not be applied till all the swelling, which is usually present at first, has subsided, otherwise when the limb has resumed its normal size the case becomes too slack, and no longer controls the movements of the fractured ends of bone, the result being an ununited fracture. After the excision of a joint, more especially the knee, the limb is often put up in a plaster case, so applied as to leave a "window" through which the wound may be dressed, but sufficiently rigid to prevent any movement between the opposed ends of the bones. In disease of the hip-joint the case must be applied to the whole length of the leg, and continued round the pelvis, to secure immobility of the joint.

Materials Required.—(1) Muslin bandages; (2) plaster of Paris (best quality); (3) dextrine; (4) boracic lint bandages; (5) scissors; (6) pail of tepid water; (7) melted paraffin; (8) one or two old blankets or sheets.

Method of Preparing Materials.—Bandages.—These are made of coarse muslin, and must not exceed three yards in length. If longer, the water will not percolate all through,

and much of the bandage will be wasted. They should be from $3\frac{1}{2}$ to 4 inches wide according to the size of the limb to which they are to be applied; and when charged they must be rolled very loosely. Unless the plaster of Paris be of the very best quality, it will not set well, and the rigidity of the splint will be diminished. Before it is used the plaster must be well dried in the oven for a few days. As this is important, in hospitals or where much plaster is used, a supply should be constantly kept preparing in the oven, so that there may be no delay when it is needed.

The case is rendered more rigid and fewer bandages are required if one part of dextrine be added to every two parts of plaster. These are thoroughly mixed and prepared otherwise in the same way as plain plaster.

To charge the bandages, spread a layer of brown paper on a large flat table, and unroll part of a bandage on it. Take from a basin a handful of the prepared plaster, and with the palm of the hand rub it thoroughly and equally into the muslin, so that all the meshes get filled up with the powder. Roll up *very loosely* the part charged, and proceed to the next part, and so on, till the whole bandage is impregnated with plaster. The reason for rolling up the bandage loosely is that the water may easily and rapidly percolate to the very centre, and to every part of the bandage.

To apply the bandages, spread an old sheet on the floor, and another on the bed or couch on which the patient lies. Wrap a third round yourself to avoid soiling with the drippings from the wet bandages. Wash the limb with soap, water, and turpentine. Apply a boracic lint bandage neatly and evenly, avoiding crossing and creases as much as possible, from the toes up beyond the part to be encased. Carefully pad any prominences, *e.g.* malleoli, condyles, etc., with nests of corrosive wool or boracic lint. Now count out the number of bandages you expect to require, and lay them apart. You are apt to lose count if you simply pick them out of the stock box as you proceed. Eight or nine plies, *i.e.* about a dozen bandages, are required for an adult; five or six plies, or about nine bandages, for a child. Next, put one bandage into the pail

of tepid water with which you have provided yourself. How do you know when it has been long enough in the water to become thoroughly saturated? When bubbles of air cease rising to the surface, the bandage is saturated. Then take it out, and after squeezing from it most of the water, begin to apply it to the limb. But before doing so, put another bandage into the pail, so that it may be getting saturated while you are applying the first. The bandage is put on in the usual way according to the part you are covering in. When you have completed the application, let the limb lie exposed for about half an hour or an hour to enable the plaster to set. If you cover up the limb before the plaster has set, the blankets prevent the evaporation of the moisture, and the result is unsatisfactory. You should not set the patient down beside a fire to dry the case, as this only bakes the outer layers, and prevents the moisture escaping from the deeper ones ; thus the bandage remains soft, and when weight is put upon it, it bends. In children, it is desirable to render an application of this sort waterproof, and this can be done by painting over it a layer of melted paraffin.

After Treatment.—Keep a look-out on the toes to guard against vascular interference. The patient often complains that the upper margin of the case is uncomfortable. If so, you may snip it all round with scissors and turn down the edges a little.

SAYRE'S JACKET.—*Uses.*—This application is used most largely in curvature of the spine due to disease of the vertebræ. It may be augmented by applying extension either to the lower limbs with the foot of the bed raised, or to the upper part of the spine from the axilla, in which case the head of the bed will be raised. When the disease is in the cervical region, extension may be applied to the head ; and when in the middle of the back it may be applied both to the head and legs.

Caution!—It is of the very first importance that the nurse should understand the rational treatment of disease of the spinal column, especially when it is situated in the cervical region. The great danger is that the ligaments which protect the spinal cord from pressure

by the bones should become softened and useless, and that during some movement of the patient's head or body the diseased bones will become displaced and pressed on the cord. In the lower part of the canal this would cause paralysis, but in the upper cervical region instant death would be the result. This has not infrequently been the result of the nurse moving the patient against the doctor's orders.

Materials Required.—Vide plaster case, repeat 1 to 7; (8) a quantity of absorbent wool; (9) vest made of boracic lint; (10) tripod for suspending patient. The bandages should be broader than for an ordinary plaster case for a limb. The vest is not made to fit very closely, and should extend a few inches beyond the plaster. It is in such cases that the toxic action of boracic acid on fleas and other body vermin is most valuable, because the case is usually left on for a considerable time—six or eight weeks.

Method of Applying Jacket.—Having thoroughly washed the skin with soap and water, all bony prominences such as the vertebral spines and iliac crests are carefully protected with pads of antiseptic wool or of boracic lint. "If the patient be a female, and especially if she be developing at the time, it will be necessary to apply a pad under the shirt over each breast before the plaster bandage is put on. These pads should be removed just before the plaster sets, and at the same time pressure should be made over the sternum for the purpose of indenting the central portion of the plaster jacket, and of thus giving form to the body and removing pressure from the breasts." (Sayre.) Sayre uses, in addition, what he calls a "dinner pad." This is a pad put over the region of the stomach, and removed just as the plaster is setting. The space thus left permits of the dilation of the stomach after food. The suspension apparatus is used so that the spinal column may be rendered as straight as possible when the jacket is being applied, in the hope that this position will be maintained by the rigid apparatus. A child may be held up by the arms, but in an adult this is obviously impossible. The apparatus (Fig. 16) consists of a tripod, from the centre of which hangs "a curved iron cross beam, to which is attached an adjustable head and chin

thoroughly washed with soap and water, is covered from the extremity towards the trunk with a boracic-lint bandage of appropriate size. All bony prominences, and other parts where it is undesirable to have pressure, are carefully padded. The splint having been accurately moulded to the shape of the limb thus protected, is fixed by means of an ordinary cotton bandage. Over this is smeared a coating of the starch, which is then rubbed thoroughly into the bandage. Another layer of bandage is applied over this, and covered with starch in the same way; and so on till three or four layers have been applied. The starch takes about twelve hours to dry thoroughly, and until it has done so no weight may be borne by it, as it will yield and be useless. Placing the part between hot bottles or in front of a fire will hasten the drying process. The appliance may be rendered waterproof by a coating of melted paraffin.

CHAPTER XVII.

APPLIANCES FOR JOINT AFFECTIONS.

SCOTT'S DRESSING.—*Uses.*—This application is used in the treatment of chronic joint diseases, especially those of a tubercular nature. It combines the advantages of the local application of mercury and of pressure, both acting in the direction of promoting absorption of the morbid products. At the same time it gives a certain amount of fixity to the joint, so securing rest, but this must be augmented by the use of some form of splint if it be deemed an important part of the treatment.

Materials Required.—(1) A quantity of plain white lint; (2) a quantity of mercurial ointment (*Unguentum hydrargyri compostum*); (3) a quantity of strong moleskin plaster; (4) domette bandage; (5) spatula; (6) scissors; (7) safety pins; (8) sheet of brown paper; (9) means of heating the plaster.

Method of Preparing the Materials.—Cut a piece of lint to extend all round the affected joint, and for an inch or two above and below it, and shaped so that when applied it will lie smoothly without overlapping. With the spatula, spread on the lint a fairly thick and even layer of the ointment. By laying the lint on a sheet of brown paper, you will avoid soiling the table while covering the edges. It is immaterial on which side of the lint the ointment is spread; as a rule it can be applied more evenly on the plain side. Next cut about twelve or fourteen strips of adhesive plaster about an inch wide, and long enough to extend a little more than once round the limb at its widest part; also, one piece of the same breadth, but long enough to go twice round the limb at the upper level of the lint.

Method of Applying the Dressing.—Having washed the whole limb with soap and water and turpentine, examine it carefully to see that there are no scratches or open sores, as by these the ointment may be absorbed too rapidly and cause symptoms of mercurial poisoning. Any scratch should be covered with some wool and friar's balsam or collodion. Of course, a joint in which sinuses exist is not suitable for treatment by Scott's dressing. The limb is now placed in the position which it is to retain while the dressing is on, and the lint spread over the part so that it lies as smoothly as possible. Heat a strip of the plaster strapping by placing its non-adhesive side against a jar containing very hot water, or by some other means; pass it round the joint so that the two ends cross in the middle of the leg in front. The first strip is at the lowest level of the lint, and each succeeding layer overlaps two-thirds of its predecessor, so that the pressure will be directed from below upwards. All the crossings should be kept in the middle line, and the ends should go about an inch and a half beyond the point of crossing, all being cut to the same length. When the upper limit of the lint is reached, the long strip of plaster which has been prepared is wound round the limb so as to cover in the loose ends at the top, and so to complete the dressing and give it a neat appearance. The whole dressing is now covered by a divergent spica bandage. If necessary, an appropriate splint may be applied over all.

After Treatment.—Keep a careful look-out on the toes to guard against undue pressure and interference with the venous return. Should the patient complain of the dressing being too tight, the edges may be snipped with scissors to relieve it a little. After a fortnight or so the whole dressing will usually be found to have become quite slack and untidy. This is partly due to the movement of the limb, but mainly to the decrease of the swelling on account of the absorption of the diseased material. It should then be removed, the joint washed, and if necessary, the dressing reapplied.

THOMAS' SPLINTS.—These appliances, introduced by the

late Mr. Thomas of Liverpool, are very largely used in the treatment of joint diseases.

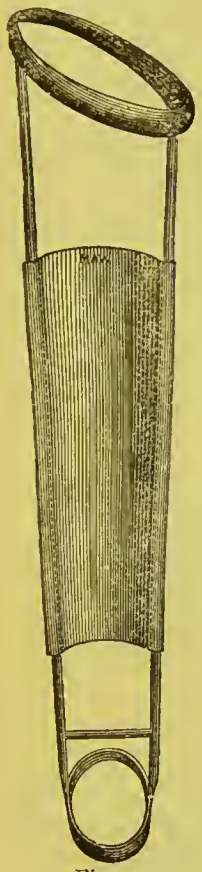


Fig. 17.

Fig. 18.

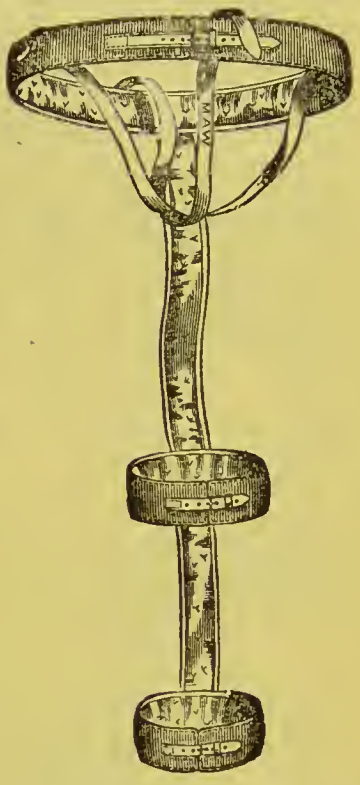


Fig. 19.

(1) *Thomas' Knee Splint* (Fig. 17) consists of two parallel iron bars surmounted by an oval padded metal ring, which is formed to fit into the perineum on the affected side. The lower end also consists of an oval ring, which rests on the ground, but beyond the level of the patient's foot. In this way the patient really sits on the upper end, with the diseased leg hanging in the splint. A patten (Fig. 18) is fixed to the boot of the opposite foot to equalise the length of the limbs. The limb is bandaged to the splint above and below the knee, and a brace is passed from the upper ring behind, over the opposite shoulder, and fixed to the upper ring again in front.

(2) *Thomas' Hip Splint* (Fig 19.).—This consists of a long bar of malleable iron fitted with three transverse pieces or crescent wings, which grasp respectively the chest, the thigh, and the calf. The splint is bandaged to the leg and thigh, and fixed to the body either by a strap with buckle, or by a roller bandage.

APPARATUS FOR DEFORMITIES.—It is beyond the scope of the present work to describe the almost endless variety of appliances used in correcting deformities. Among the more commonly used are :—

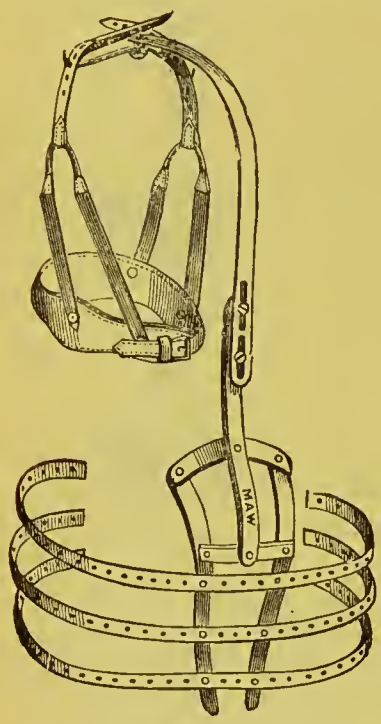


Fig. 20.

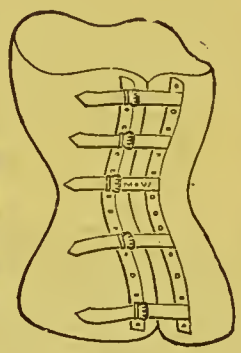


Fig. 21.

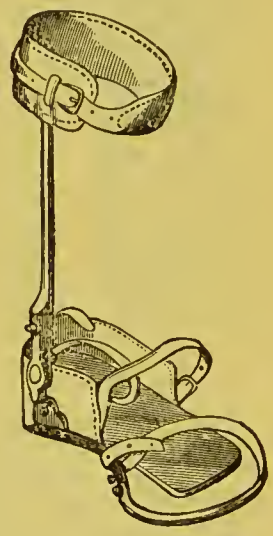


Fig. 22.

(1) *Sayre's Jury Mast* (Fig. 20), often incorporated with a plaster jacket (page 84) ; (2) *Felt Jacket and Jury Mast ;* (3) *Simple Poroplastic Jacket* (Fig. 21) ; all of which are useful in the treatment of diseases or deformities of the spinal column.

For the different forms of club foot various forms of boot are used, for example that of Scarpa (Fig. 22).

CHAPTER XVIII.

APPLIANCES FOR FRACTURED BONES.

As a general rule it may be said that in the treatment of fractures the less specialised splints are the better. There are, however, certain cases in which particular forms of apparatus are advantageous.

Apparatus for Superior Extremity.—Very many forms of

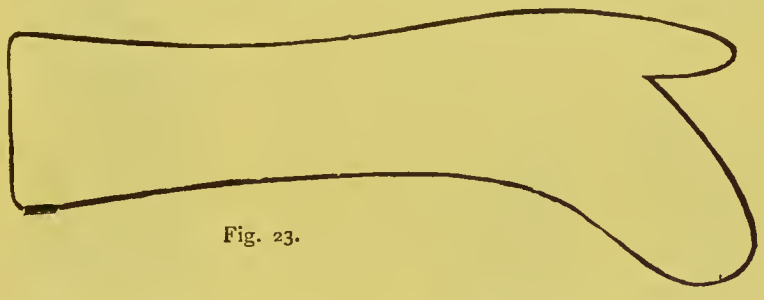


Fig. 23.

splint have been introduced for the treatment of Colles' fracture of the lower end of the radius. No one is superior to that made from Gooch material, cut so as to avoid pressure on the ball of the thumb, and padded and bandaged in such a way as to correct the characteristic deformities. Of the others may be mentioned the *pistol-shaped* splint (Fig. 23); *Carr's* splint (Fig. 24); and *Gordon's* splint (Fig. 25), all of which are designed to counteract the displacements peculiar to fracture in this situation.

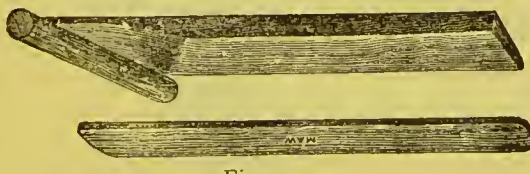


Fig. 24.

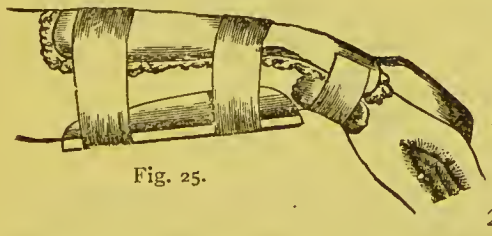


Fig. 25.

For the arm an angular splint is often required, and it is an advantage to have it jointed so that the angle may be varied to suit individual cases. In some cases a shoulder-cap is added. Both of these can be readily moulded in poroplastic. To support the elbow a hollow splint of poroplastic or wire-gauze may be employed (Fig. 26).

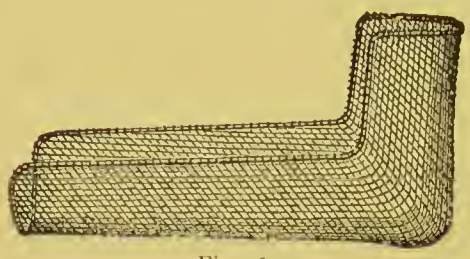


Fig. 26.

Apparatus for Inferior Extremity.—Of the specially made splints used in fracture of the bones of the leg it is perhaps only necessary to mention those of Cline (Fig. 27), the outer half of which is furnished with a foot-piece ; and the hollow splint of wire-gauze (Fig. 28).

Fig. 27.

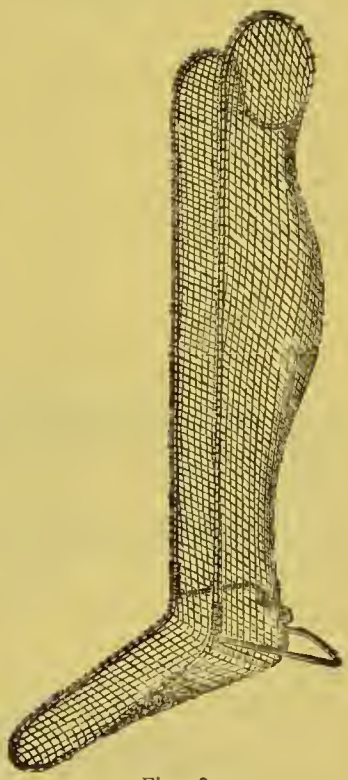


Fig. 28.

Malgaignes Hooks (Fig. 29) are employed to approximate the fragments of a fractured patella, the claws being fixed

Fig. 29.

into the fragments of the bone, or as suggested by Prof. Annandale, into adhesive plaster applied round the limb above and below the fragments.

Box Splint.—This splint, which is often associated with the name of the Edinburgh school, is largely used there in the treatment of all fractures of the bones of the leg, as well as in other conditions in which it is necessary to control the movements of this part of the limb. It has the great advantage of being readily and quickly made, all the requisites being procurable anywhere.

Materials Required.—(1) Two wooden splints; (2) a small sheet; (3) two towels; (4) some cotton wool, antiseptic if possible; (5) four "nests" of cotton wool; (6) a cotton bandage for slip knots; (7) a domette or elastic bandage for foot; (8) scissors, safety pins, etc.

Method of Preparing the Materials.—The *splints* should be of strong wood, measuring four inches in breadth and extending from above the knee to three or four inches beyond the sole. The *sheet* having been folded to correspond with the length of the splints, one of the latter is laid on each end of the sheet and rolled up in it. Three sides of a box are thus formed. The splint should be fitted on to the sound limb (allowing for padding) to avoid disturbing the injured part unnecessarily. If it be found that the space between the two sides is not accurate, only one end should be unrolled, and by folding in or letting out the sheet, the proper size will be obtained. The *wool* is used to pad the whole of the inner surface of the box, and with it small round rings, or "nests," are made to place over the condyles of the femur at the knee and the malleoli at the ankle to avoid undue pressure on these prominences. The hollow behind the heel, *i.e.* under the tendo Achillis, and the space

behind the knee (popliteal space), also require special support. The *towels* are then folded so as to cover in the front of the leg, forming, so to speak, the lid of the box. By using *two* towels, one covering the upper and the other the lower half of the limb, the parts may be examined frequently by undoing the middle slip-knot and folding the towels up and down. In this way the apparatus is very little disturbed. The *slip-knot loops* are made thus: An ordinary six yard cotton bandage is run out and divided into three equal parts. Each part doubled upon itself constitutes a slip-knot loop.

Method of Applying the Splint.—The bones having been put into proper position, and being held there, the splint is slipped under the limb and the sides of the box are then folded up, the pads carefully adjusted, so that the pressure is properly distributed, and the folded towels laid on the front of the leg. While the whole apparatus is fixed by an assistant the three slip-knot loops are passed under the limb from without inward so that the two free ends lie towards the outside. One is placed at the middle, one just above the ankle, and the other just above the knee. The middle one should be tied first. This is done by passing one free end through the loop of the double end and pulling tight, then fixing by means of a reef bow, which should be placed over the outer splint. The others are then fixed in the same way. The *domette bandage* is applied to correct any twisting of the foot that may exist, to keep the foot at right angles with the leg, and to support the part generally.

Advantages of the Box Splint.—(1) Its simplicity; (2) material always available; (3) its general applicability; (4) the limb can be examined without removing the splint, and thus rest constantly maintained.

Special splints used in the treatment of Pott's fracture of the fibula are—(1) *Dupuytren's Splint*, which is simply a "short long-splint." In preparing this appliance, the *materials necessary* are (1) the splint, (2) one towel, (3) two bandages, (4) slip knots. The towel folded to the width of, and something longer than, the splint, is laid on one side, and the surplus folded in to make a pad; the tail of one bandage is split longitudinally for a couple of inches,

and the ends fastened through the holes at the top of the splint. The bandage is then carried along the towel and fixed there by two or three slip knots (Fig. 30).

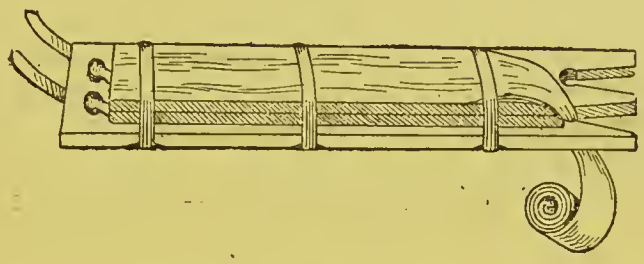


Fig. 30.

The *Horse-Shoe Splint* is also sometimes used. It is prepared in the same way as that of Dupuytren.

MacIntyre's Splint is also used for various conditions of the leg (Fig. 31), for example, serious injuries and some

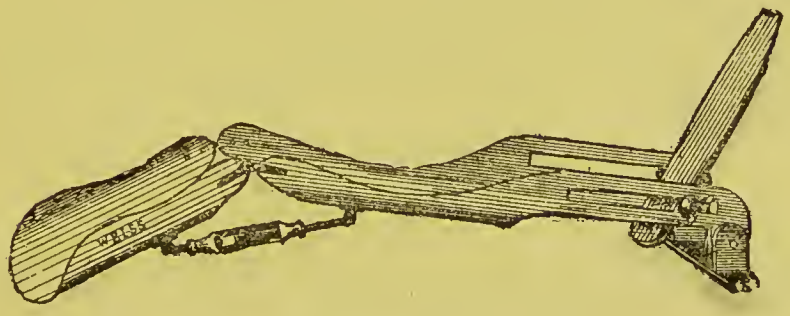


Fig. 31.

joint affections. It may be used as a straight posterior splint or as a double inclined plane, the angle being varied by means of a screw acting on a hinge which joins the upper and lower parts. It is furnished with a foot-piece, which may be placed at any desired angle, and which may be moved up or down to suit the length of limb of the patient. Precautions must be taken to support the heel;

either by bandaging under it or by fixing the foot securely to the foot-piece.

Sand Bags are very useful for securing and maintaining rest. They can be placed alongside broken limbs, and so act as a temporary splint. The sand must be very fine and *perfectly dry*, and the bag should be filled only about two-thirds full, otherwise it does not adapt itself readily to the shape of the parts. The bag should be made of some very close material, such as bed-ticking, to prevent the sand escaping.

The Long Splint (Fig. 32).—*Uses.*—This splint, which is

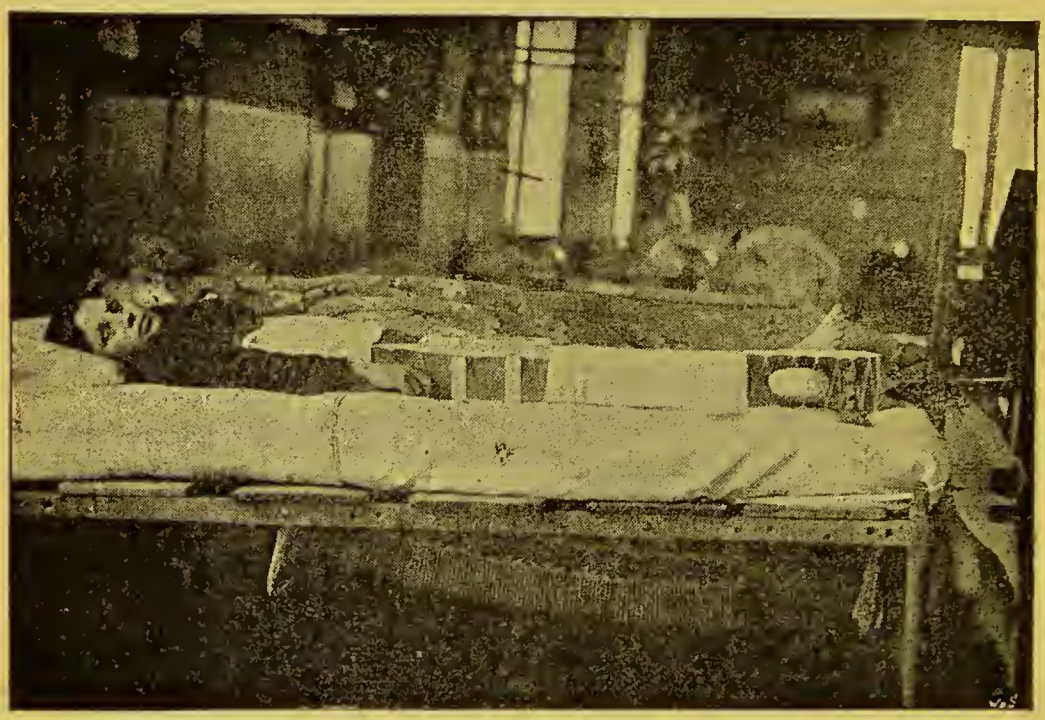


Fig. 32

associated with the name of Liston, who introduced it, is largely used in the treatment of fractures of the femur, whether of the neck or shaft. It controls the whole limb and the movements of the trunk on the thigh at

the hip joint, thus securing absolute rest to the injured part. It may be used single or double, *i.e.* one on each leg. It is often used as an addition to other splints, as in fracture of the shaft of the femur, where the break in the bone is first controlled by means of short Gooch splints, and then the whole limb by a long splint. The double long splint is used chiefly in children, where the difficulty of keeping them from wriggling about is so great. It also facilitates the cleansing of the child. Some adults are not less easily kept quiet than children, and in such, a double long splint is of great value.

(1) *Single Long Splint.*—There are two methods of employing this splint; the old way, in which extension is applied by means of a perineal band; and the more modern, and much preferable way, in which the ordinary apparatus with weight and pulley affords the necessary extension. (*a*) *Old Method:* Materials required—(1) Long splint, with foot rest; (2) sheet; (3) wool for padding; (4) several long strong pins (cap pins); (5) many-tailed domette bandage; (6) two large handkerchiefs; (7) safety pins.

Method of Preparing Materials.—The splint is about four inches broad, and extends from the axilla to an inch or two beyond the foot. About two inches from the upper or axillary end are two holes about the size of a shilling piece, two inches apart; while at the lower end two triangular wedge-shaped pieces are cut out, giving a double fork.

Lay the splint alongside the patient, with the upper end well up in the axilla, and mark on it with a pencil the level of the great trochanter at the upper end of the thigh, and of the external malleolus at the lower end. Now fold the sheet to this width, and roll it carefully round the splint, covering only the part between the two pencil marks, and leave as much of the sheet unwound as will encircle the limb and leave a margin with which to fix the apparatus. To compensate for the greater circumference of the leg at its upper part the sheet should be folded slightly obliquely. It is sometimes desirable that the sheet should pass from the splint over the front of the limb, and then encircle it,

sometimes over the back of the limb. This depends on whether eversion or inversion has to be corrected, and the sheet will be folded round the splint accordingly. Having enclosed the splint in the sheet, carefully pad the upper part which comes into contact with the side of the chest. This is best done with evenly cut pads of wool tied on to the splint with pieces of bandage, leaving the holes free. The leg should be thoroughly washed with soap and water, and dusted with a mixture of powdered boracic acid and starch, and then all bony prominences carefully padded with antiseptic wool. All being ready, the free part of the sheet is passed under (sometimes over) the limb, which is carefully steadied and held in the proper position by a competent assistant, and having been brought round is fixed to the part enclosing the splint by means of long pins. The foot is fixed to the lower end of the splint by passing one of the handkerchiefs, folded *en cravatte*, round the foot, beginning at the sole and crossing over the dorsum, then around the ankle and passing the loose ends under the turns which cross the dorsum, and then tying the ends through the notches at the foot of the splint. Now by gently pushing on the upper end of the splint, in its long axis, the leg is drawn upon and extended. How is this extension to be kept up? By means of the other handkerchief—the perineal band. This is folded *en cravatte* and passed under the perineum, and the two ends brought through the holes at the top of the splint, passing from within outward. By tightening these ends the splint is pushed down and keeps up the extension on the foot. The splint is prevented from rocking by means of a foot piece. The many-tailed bandage fixes the splint to the patient's body, and prevents movement at the hip joint.

The Disadvantages of the Perineal Band Method are:— (1) That the handkerchiefs gradually yield to the strain, elongate, and so the extending action is lost, and the constant re-adjustment interferes with the absolute rest which is so essential to the successful treatment of these cases; (2) the parts with which the handkerchiefs are in contact are constantly being chafed, and soon get excoriated, adding

additional inconvenience to the patient; (3) in spite of all precautions, the perineal band gets soiled, especially in children, and the necessity for changing it interferes considerably with its usefulness.

We have described this method fully because it is very useful, especially in district and private nursing practice, where on account of the shape and arrangement of beds, and for other reasons, the extension apparatus is unavailable. When it is possible, however, it is advisable to use the extension apparatus.

Double Long Splint.—This is simply the application of a single long splint to each leg, the lower ends of the two being fixed into a common foot-piece. The advantage of thus fixing both legs is that it prevents all movement, and, in children especially, facilitates cleanliness.

Vertical Extension (Fig. 33) is another method of treating fracture of the thigh in children. It consists simply in hanging the child up by the feet with the limbs at right angles with the trunk. Extension plasters are applied to each limb and the tapes attached to a cross-bar over the bed. This is of great assistance in keeping children quiet as well as clean and dry.

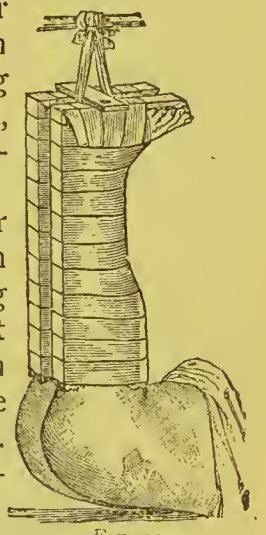


Fig. 33.

(*b*) *Long Splint with Extension Apparatus.*—*Materials Required.*—Same as for the old method, and, in addition, all the apparatus needed for extension (page 77).

Method of Application.—The extension being applied as before directed, the splint is prepared and adjusted in exactly the same way as already stated, save that the perineal band is omitted. The foot of the bed must be raised to obtain the necessary counter extension.

Advantages of this Method.—The extension is constant; there is little chance of the apparatus being soiled, and no danger of excoriation if proper precautions be taken to pad all prominences; it is thus easier to insure the maintenance

of absolute rest, which is the secret to rapid and accurate union.

Gooch Splints.—A great variety of splints are prepared from Gooch's material (Fig. 34), which "consists of flat boards about an eighth of an inch thick, glued on to oil-cloth or leather, and split into parallel strips about one-third of an inch wide by longitudinal incisions, which do not completely divide them. It is flexible in one direction and quite rigid in the other."

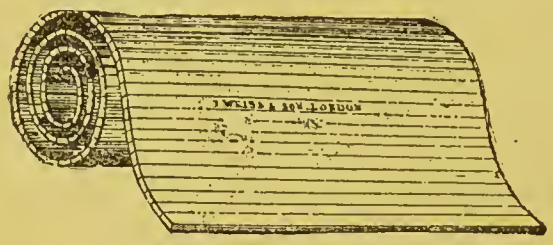


Fig. 34.

To form a splint one should have (1) Gooch splint material; (2) a medium-sized saw; (3) a strong knife; (4) wool for padding; (5) bandages; (6) slings; (7) scissors, safety pins, etc.

The desired splint is cut to fit the part, provision being made to avoid pressing on bony prominences; it is carefully padded and fixed in position with slip-knots, over which a bandage is applied to secure all. Sometimes, *e.g.*, in fractures of the shaft of the humerus or femur, the leather side is put nearest the skin, and so the splint adapts itself to the shape of the limb, while in other fractures, especially where there are two bones, for example in the forearm, the wooden side goes down to keep the splint rigid.

Fractures of the lower jaw are usually treated with

Fig. 35.

splints moulded out of gutta-percha or poroplastic

(Figs. 35, 36), and held in position by means of a four-tailed bandage (Fig. 37).

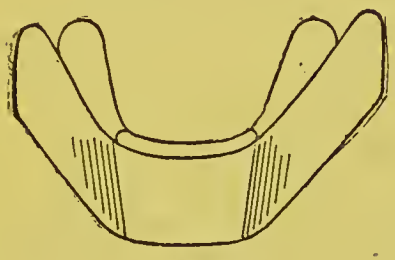


Fig. 36.

Fig. 37.

For *fractures of the nose* a special apparatus (Fig. 38)

Fig. 38.

is sometimes used, but is by no means necessary in most cases.

SECTION III.—BANDAGING.

CHAPTER XIX.

PRINCIPLES OF BANDAGING.

It is scarcely necessary to indicate in any but the briefest manner the numerous uses to which the bandage is put in surgery. All dressings, fomentations, and compresses are fixed and retained in position by one or other form of bandage; and almost all splints, whether applied to control fractured bones, to insure immobility of joints, or to correct deformities, are similarly secured. Bandages are oftenest used alone, but are sometimes impregnated with various substances, such as starch and plaster of Paris, to give rest or stability to different parts. As a means of preventing and of arresting hæmorrhage, and of influencing the size of certain forms of swelling also, different varieties of bandage are of great value.

Materials.—The variety of uses to which bandages are put is only exceeded by the materials from which they are made.

(1) *Linen*, *cotton*, and *calico* form useful, strong bandages, varying in strength and stiffness according to the quality and newness of the material. They are softest and lie best when made of old stuff which has been frequently washed. These bandages are not antiseptic, and must therefore never be used in dressing open wounds, or in applying antiseptic fomentations or poultices to an unopened abscess.

(2) *Gauze.*—This material is usually charged with some antiseptic agent, and so can be employed with safety in dressing aseptic wounds. Sir Joseph Lister first used

gauze impregnated with carbolic acid, and later with the double cyanide of mercury and zinc.

(3) *Domette* is a variety of soft, elastic flannel, and bandages made of this material fit nicely to the part, and do not tend to slip, as stiffer forms sometimes do. They are usually rendered antiseptic by being charged with salalembroth, and as they wash well, may be used repeatedly, provided always they are first reimpregnated with the antiseptic.

(4) *Muslin*, strong and coarse, with wide meshes, is used in making plaster of Paris bandages, the dry plaster being rubbed into the muslin filling up the meshes.

(5) *Elastic Webbing* is a form of bandage in which the longitudinal strands are made of rubber, the transverse ones of cotton. Such a bandage is used to apply a moderate amount of pressure or elastic support to any part—*e.g.*, a joint into which there has been some effusion, or in a case of varicose veins. The open network has the advantage over simple elastic bandage of permitting evaporation of the sweat, which, if retained, irritates the skin.

(6) *Martin's Elastic Bandage* is made of a sheet of thin india-rubber. It is chiefly used in the treatment of varicose veins of the leg, but, as just mentioned, is objectionable in retaining perspiration.

(7) In cases of emergency *old household linen* (short of being rotten—the older the better) makes very good bandages.

Varieties of Bandages.—The commonest form of bandage used in surgery consists of a length of material rolled tightly up from end to end, constituting a simple *roller bandage.* When rolled from one end only it is spoken of as a *single-headed roller*, when from both ends as *double-headed.* It will be necessary later to describe certain forms of compound bandage, such as the *many-tailed*, *four-tailed*, *T-shaped*, and so on, each having a special use.

Names have also been invented to indicate the various methods of applying a bandage to a part, depending on the arrangement of the turns of the bandage. For example, a *circular* bandage is one in which each succeeding turn exactly covers the one which preceded it ; an *oblique* bandage simply takes its own course round the limb, covering

parts, and leaving others bare; a *spiral* bandage, evidently from its name, winds spirally round the limb, but each succeeding turn overlaps only two-thirds of its predecessor. An important modification of the last is the *spiral bandage with reverses*, in which the bandage is folded over on itself at regular intervals, to ensure that no spaces are left between the turns uncovered. The *figure-of-eight bandage*, as its name implies, consists of two almost equal circular turns, one being above, the other below the point of crossing. It is chiefly employed in covering in joints. Closely related to it is the *spica bandage*, so named from a fancied resemblance to a spike of barley. In it one circle is larger than the other, and it is employed in bandaging parts where two unequal cones meet, as, *e.g.*, at the shoulder or groin. The indications for selecting one or other of these forms will be pointed out later on, as well as the means of carrying out the manipulations (page 107).

Parts of a Bandage.—For purposes of description, names are applied to different parts of a bandage. Thus the part of a roller bandage which is still unrolled is spoken of as the *head*, and naturally the loose end is referred to as the *tail*. The *anterior surface* is that on which the head rests, while, of course, the opposite side is *posterior*. As the bandage is being applied to a limb, the edge nearer the trunk of the body—that is higher up the limb—is called the *upper margin*, and the other the *lower margin*. Such names are not necessary when a practical demonstration of bandaging is being given, but they facilitate a word description of the appropriate manipulations.

Sizes.—It is obvious that different widths of bandage will be necessary for different parts of the body, bearing some proportion to the circumference of the part to which they are applied. The sizes usually recognised are:—

For upper extremities and head, 2½ in. wide.
For lower extremities and pelvis, 3 to 3½ in. wide.
For thorax and abdomen, 4 to 4½ in. wide.

These are respectively known as "sixteens," "twelves," and "eights," because from a piece of calico one yard wide sixteen bandages of the first size, twelve of the second, and

eight of the third can be obtained. They should all be six yards in length.

To Make Bandages.—In their surgical handbook, Caird and Cathcart describe the process briefly as follows:—"Procure six yards of calico, about one yard in width, and remove the selvedges. Mark off with scissors short strips of the desired breadth; then grasp the alternative strips gathered in two bundles, and pull in opposite directions." In this way a number of strips can be rapidly and evenly torn, and must then be rolled. This may be done either with the hand or with a machine made for the purpose, the main objects being to have the bandage tight and evenly rolled. When using the bandage machine some difficulty will be experienced in withdrawing the pin from the centre of the bandage unless the first few turns be made rather slack, and the handle reversed once or twice while the completed roll is firmly grasped by the hand. Tie a few threads from the edge of the bandage round the roll to prevent it coming undone.

The Parts to be Bandaged.—The exact variety of bandage to be used in any given case depends entirely on the shape of the part to be covered in, and if we consider the shape of any segment of the body we shall find that it is either a *cone* or part of a cone, or else is made up of the *junction of two cones.* Here and there short areas, more or less *cylindrical*, are to be met with, but these soon become conical. For example, take the upper extremity—from the finger tips to the middle of the palm of the hand we have a slight cone, the base being at the latter level, and from this starts another with its apex at the wrist. Just above the wrist we meet with a short cylinder, which, however, soon expands into the cone of the forearm. At the elbow joint this cone meets that of the upper arm, giving us a well-marked junction of cones. And so on all over the body, the lower extremity, the trunk, and even the head and neck being each capable of resolution into these geometrical forms.

For cylinders use the simple spiral bandage;
For cones use the reversed spiral;
For junctions of cones use the figure-of-eight.

Rules for Bandaging.—There are certain general principles and special rules always to be borne in mind in applying a bandage, and, trifling and unimportant as some of them may appear at first sight, it is well to pay some attention to them, as much of your success as a bandager, and still more of your patient's comfort, depends on the way in which they are appreciated and applied.

(1) If possible, stand in front of your patient in applying a bandage.

(2) Never put a bandage next the skin. Always have a layer, however thin, of absorbent wool between the bandage and the skin of the patient. This will prevent the retention of the cutaneous secretions, which, decomposing, cause irritation ; as well as the chafing and even abrasion of the skin so often induced by hard, non-porous bandages. Sometimes it may be allowable to use domette without wool, *e.g.* when the bandage is only to be left on for a few hours, but when applied for lengthened periods you will be wise to keep by the rule.

(3) Never let skin surfaces be apposed. Thus, when the hand or foot is bandaged up, the fingers and toes should be separated by layers of absorbent wool ; when the arm is bound to the side, a pad should intervene between it and the chest wall ; and in females with pendulous mammæ, the adjacent skin surfaces should be similarly protected. The result of neglecting this precaution is, that the decomposition of the sweat and other skin secretions is the source of irritation which may even set up an inflammation or even superficial ulceration of the skin.

(4) In bandaging a limb, always place it in the position it is intended to occupy afterwards. By doing so you will avoid the risk of your bandage becoming slack on the one hand, or constricting the part on the other.

(5) Fix the bandage to begin with. The reason for this is obvious. It is best done by making a figure-of-eight turn round the nearest joint.

(6) Apply the bandage *from below upwards*, and *from within outwards*, passing over *the front* of the limb. By proceeding from the distal extremity towards the trunk you avoid engorgement of the limb, which would inevitably

happen did you reverse the direction. Passing from within outwards, and over the front of the limb, is rather a matter of convenience than necessity.

(7) Use equable pressure throughout. This is most important, as otherwise you will have one part of the limb tightly constricted, leading to congestion and œdema of the part beyond, and all degrees of harm, from slight discomfort up to actual gangrene of a limb, have resulted from want of attention to this rule. A watch must always be kept on the tips of the fingers and toes, and, on the appearance of the least œdema or discolouration, remove the bandage at once and reapply it, using more padding or less tension as you find indicated. These precautions are specially necessary in children.

(8) Each turn of the bandage should overlap two-thirds of that which preceded it. This helps to ensure equable pressure, gives the bandage a certain amount of rigidity, in addition to making it look neat.

(9) Keep all the margins parallel, all the crossings and reverses in the same line, and rather towards the outer aspect of the limb. By so doing you will attain to some degree of neatness.

(10) Finish the bandage by securely fixing it. This is best done by means of a safety pin, which should always be inserted in the long axis of the bandage, and not across it. Failing a safety pin, the end of the bandage may be slit into two tails, one brought back over the limb and tied in front with the other. This should be tied in a reef bow or knot.

Knots.—In bandaging the only knot which is permissible

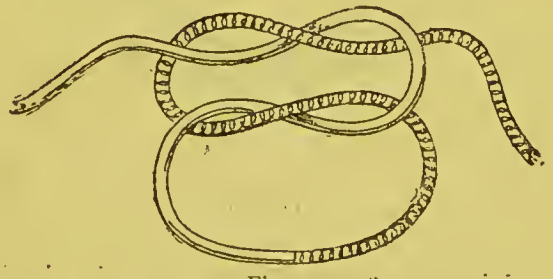


Fig. 39.

is the *square or reef knot* (Fig. 39), in which both ends of the

bandage pass in the same direction through each loop, and when tied the loose ends lie parallel with the turns of the bandage. In making it, keep the end which is further from you in making the first turn also the farther away in making the second.

The *granny-knot* (Fig. 40) is more apt to slip, and the

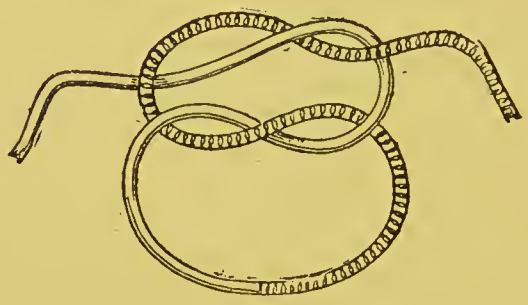


Fig. 40.

loose ends lying at right angles to the first turn, it is less neat.

The *clove hitch* (Fig. 41) is used to fix a patient in the

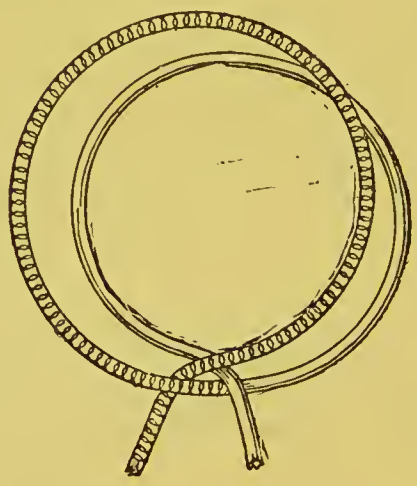


Fig. 41.

lithotomy position, or to restrain the limbs during an operation. It has the advantage of never getting tight enough to injuriously constrict the limb, however much it is pulled

upon. It is made as follows: "Grasp the bandage with the left hand supine and the right prone; now pronate and supinate the two hands respectively, and slide both loops into the left hand." "Another plan is to make two successive loops in the same direction, and place one behind the other" (Caird and Cathcart).

The *surgeon's knot* (Fig. 42) is made by doubling the first

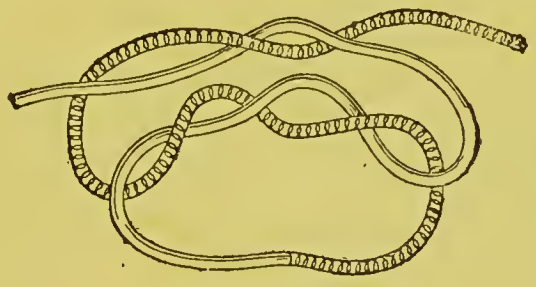


Fig. 42.

turn of a reef knot. It is less likely to slip and become slack while you are making the second turn. It is especially useful in ligaturing blood-vessels.

How to Remove a Bandage.—This should be done by simply reversing the manipulations made in applying it. The terminal end should be taken in one hand and then passed behind the limb into the other, and so on from one hand to the other as each turn is removed, the loose bandage being gathered evenly into a bundle, and not twisted upon itself. This means of removal facilitates the re-rolling of the bandage, or the washing of it if this be necessary and permissible.

Having thus laid down the general principles which are to guide us in applying all forms of bandages, it may be well to describe in some detail a few of those more commonly used, and if the manipulations described be actually gone through by the reader, the descriptions will be very much more easily followed; in fact, without practising the application of the bandages the time spent in reading the directions will be simply wasted.

CHAPTER XX.

SPECIAL BANDAGES.

BANDAGES FOR LOWER EXTREMITY.—*Bandage for the Foot and Leg.*—If we examine the shape of these parts of the body we shall find that we have first to deal with "a cone" extending from the toes to the heel, and this will require to be covered in by a spiral bandage with reverses. At the heel this cone meets another, that from the heel to the ankle, giving rise to a "junction of cones," in which case a figure of eight is indicated. At the ankle we have a short "cylinder," for which the simple spiral is employed; and higher up for the cone of the calf we return again to the reversed spiral. Bearing these points in mind, and applying the other rules already given, stand in front of the patient, having the limb held in the position it is intended to occupy, and carefully apply the wool. The initial end of the bandage must now be fixed. This is done by making a figure-of-eight turn round the ankle. To do so *(a)* lay the tail of the bandage against the ball of the great toe, and fix it there with the thumb; *(b)* carry the bandage across the dorsum of the foot to the outer malleolus; *(c)* go behind ankle to inner malleolus; *(d)* across dorsum again to the ball of the little toe; and *(e)* across the sole to the point of starting. The bandage is now fixed, and we have to proceed to cover in the foot. Allow the bandage to go spirally round the foot, leaving one-third of each turn uncovered by the succeeding one, so long as the folds lie evenly. So soon as ever the bandage tends to stray we must begin to make reverses.

To make a reverse neatly three points are to be attended to: First, to fix the part of the bandage already applied by

pressing on it with the thumb of the disengaged hand; second, to free about three inches of the tail, and to allow this to remain *perfectly loose;* then, third, turn the head of the bandage down and allow the loose tail to fall into position. Do not try to twist it into position or you will fail to make a neat reverse.

Now pull the bandage tight, and proceed as before, repeating the reverses, keeping them all in the same line, and rather towards the outside of the foot, until the heel is reached. The figure-of-eight now is to be made. Instead of reversing let the bandage go across to the external malleolus, then round the back of the ankle to the internal malleolus, then over the dorsum, keeping the crossing in the same line as the previously made reverses, and passing round the outer border of the foot, travel under the sole to the point at which the figure-of-eight started. This is to be repeated until the heel is sufficiently covered in, and then the ankle and calf are to be bandaged after the appropriate methods. To finish the bandage a figure-of-eight turn is made round the upper part of the calf, and the terminal end fixed by means of a safety pin inserted parallel to the edges of the bandage, or by tearing the end into two tails, and tying these in a reef knot.

Of course, should it be necessary to cover in *the whole of the lower extremity* right up to the groin, the bandage just described, instead of being finished at the upper end of the calf, is continued upwards over the knee, which is covered in by a series of figure-of-eight loops, on to the thigh, where the reverse spiral is employed; and to finish and secure the terminal end, a figure-of-eight turn is made round the pelvis.

To cover in the Heel Alone.—This is best done by what is called a *divergent spica*, that being merely a modification of the figure-of-eight. It is called divergent, because the first turn covers in the most prominent part of the heel, and from it the succeeding turns diverge. As elsewhere, the bandage must first be fixed. To do so, place the tail over the external malleolus, carry the bandage downwards across the sole to the internal malleolus, thence across

the dorsum and round the ankle, catching in the tail with which you started. The bandage is now fixed, and the head is over the inner ankle. Carry it straight across the tip of the heel, and in doing so you will leave small pockets above and below. The next turn goes a little lower than the last, catching up and covering the corresponding pocket, and the succeeding one going higher similarly disposes of the upper pocket. With one or two more turns diverging from the tip of the heel that part can be completely covered in.

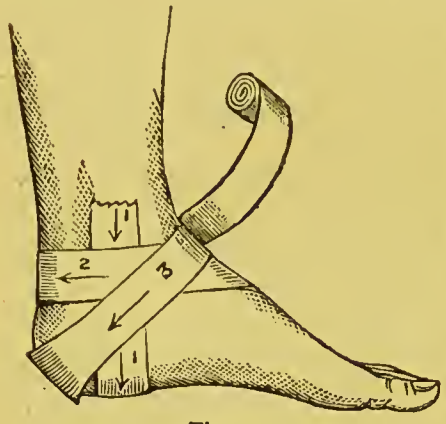


Fig. 43.

Bandages for the Knee.—(*a*) *Divergent Spica.*—This is employed when it is desirable to permit of a slight amount of movement at the knee joint, as the different layers of bandage glide over one another like the plates of scale-armour. Slightly flex the limb, and begin by making a turn round the most prominent part of the knee a second turn overlapping the lower part of this, and a third overlapping the upper part. Succeeding turns continue to diverge till the whole joint is covered in. It is obvious that the anterior aspect of the knee is the least firmly supported by this bandage, but the presence of the patella renders many layers unnecessary here.

(*b*) *Convergent Spica* is simply a figure-of-eight put on, so that the successive turns converge towards the centre of the patella. It is used when fixation of the joint is aimed at, or to approximate the fragments in fracture of the patella.

BANDAGES FOR THE GROIN.—Bandages for the groin are used to retain any form of surgical dressing or apparatus in position, as well as in the treatment of hernia. The spica is the form of bandage selected in this region, and it may either exert pressure from below up-

wards or from above downwards, according as the ascending or descending spica is applied. The ascending spica, in which each succeeding turn goes higher up the limb than its predecessor is that usually chosen when fixing a splint or a dressing. In exerting pressure on a hernia, however, the form of spica varies according as we are dealing with a femoral or an inguinal hernia.

Thus, it will be remembered that an inguinal hernia leaves the abdomen at the internal abdominal ring, passes *downwards* through the inguinal canal, out through the external ring, and continues to pass *downwards* into the scrotum. Therefore, to return this form of hernia to the abdominal cavity, and to retain it there, pressure must be exerted *upwards*, and this is effected by the ascending spica.

On the other hand, in femoral hernia, although in the first instance the bowel passes downwards in the crural canal, when it emerges from the saphenous opening, its direction is changed, and it passes *upwards* over the front of the abdomen. Hence, for its reduction, pressure must first be from above *downwards*, the direction in which a descending spica presses.

(*a*) *Ascending Spica of Groin.*—Place the tail of the bandage over the external abdominal ring, that is, at the upper and inner aspect of the groin, on the ruptured side, and thence carry a turn round the pelvis, going towards the *same* side, back to the point from which you started. This is one loop of the figure-of-eight (Fig 44). The other is made by continuing the bandage across the front of the thigh, round its outer and posterior aspects and into the perineum from behind, again reaching the starting point. Each turn overlaps two-thirds of the one before it, and with three or four such turns the bandage is complete.

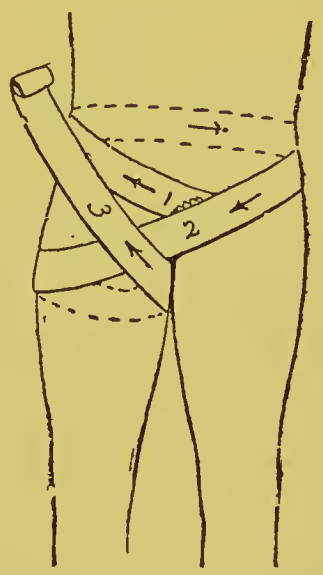


Fig 44.

(b) Descending Spica of Groin.—Again begin with the tail over the point from which the hernia emerges, in this case the saphenous opening. Then carry it round the pelvis, going first towards the *opposite* side, however, and so it will come across the front of the thigh and enter the perineum from the *front*, thence round the outside of the limb, back to the starting point. The following turns pass from above downwards, and exert their pressure in this direction (Fig. 45).

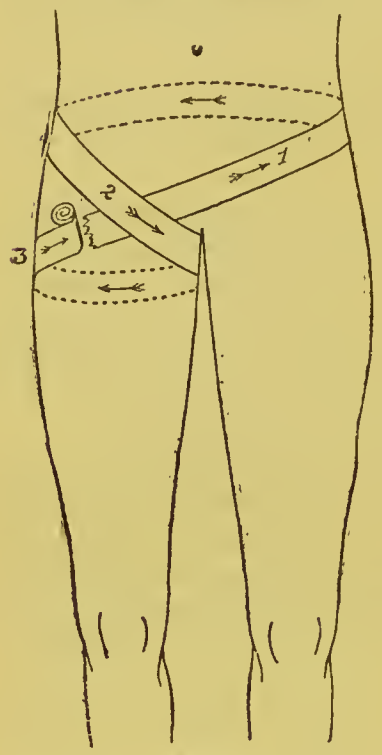


Fig. 45.

(c) Double Spica of Groin.—This bandage may be used for fixing dressings to both groins. In the treatment of hernia, it would only be applicable in cases where there was an inguinal hernia on one side, and a femoral on the other, as one side is an ascending, the other a descending spica. Such a combination of herniæ is rare, and when we have to deal with a double hernia of the same kind we apply two similar bandages, rather than the double spica.

To apply the double spica make one figure-of-eight turn as for an ascending spica, say on the left side, and then, instead of making a second, cross the middle line of the body and make a figure-of-eight round the right thigh. This will be a descending spica. Repeat these turns alternately till both groins are covered in.

BANDAGES FOR PERINEUM.—The *St. Andrew's Cross bandage*, or looped bandage, for the perineum, is useful for retaining dressings on that part. It consists of a series of loops applied alternately round the pelvis and across the perineum. Begin by laying the tail of the bandage over the right side of the pelvis, and make a turn round the body so as to catch in and fix the tail.

Now pass across the front of the right thigh into the perineum and, *crossing the middle line*, let the bandage pass round the back of the left thigh and cross the buttock to the pelvis, round which a turn is made, and then the second perineal turn is made in the same way as the first, only from the opposite side, the two turns crossing in the centre of the perineum form a St. Andrew's Cross. Similar turns are added till the dressing is secured.

The T-*shaped* bandage for the perineum is made by sewing together two pieces of bandage so as to form a letter T. The horizontal part of the letter is to encircle the pelvis, with the vertical part hanging down behind. The latter

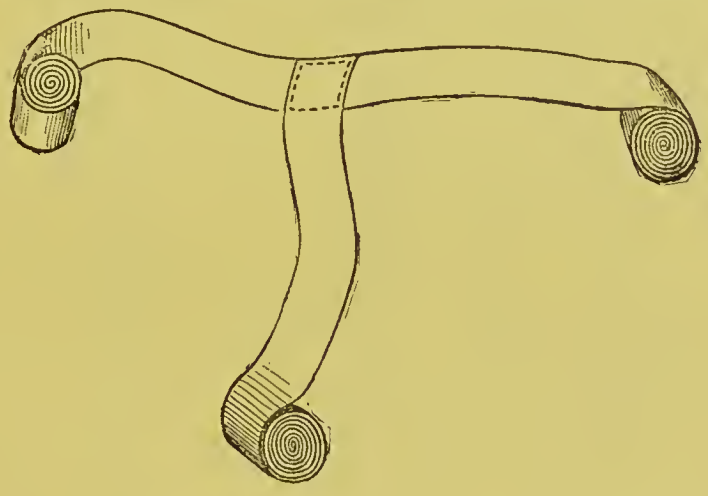


Fig. 46.

is then brought forward between the thighs, the ends split to avoid the scrotum, and fixed to the former, and a perineal dressing is thus retained in position. By using this bandage dressings can be frequently changed without much disturbance to a recumbent patient (Fig. 46).

Two triangular handkerchiefs make a good perineal or suspensory bandage. One is applied round the pelvis as a belt, to which the apex of the other is tied behind, the base being carried through between the legs, spread out, and fixed to the belt in front.

Note that the turns of these bandages go round the *pelvis*, which is a fixed portion of the body, not round the waist,

Fig. 47.

where the movements of the patient soon permit it to become quite loose.

HANDKERCHIEF BANDAGES FOR LOWER EXTREMITY.—The handkerchief bandage originally used by Gerdy and Mayor of Lausanne, but usually associated with the name of Esmarch of Kiel, is particularly useful for temporary and emergency dressings, and is largely used in military surgery. The handkerchief may be square or triangular in shape, the latter being the more generally useful. The base of the right-angled triangle should be a yard and a half long, and the material from which it is cut should be at least one yard wide. The ends are tied into a reef-knot or bow, or fixed with a strong safety pin (Fig. 47).

For the Foot.—The base is folded up for a short distance *en cravatte*, and then the foot is laid on the handkerchief, the apex being well beyond the toes. The apex and edges are neatly folded up over the foot, the base passed round the ankle and instep and the ends secured.

For the Knee.—The triangular handkerchief is laid over the dressing and the ends brought round and firmly tied, the loose edges being carefully folded in.

For the Hip or Buttock.—Two triangular bandages are required. The first is folded *en cravatte*, and tied round the pelvis as a belt. The second is held with the base downwards and the apex up, the intermediate part covering over and securing any necessary dressing. The base is fixed round the upper part of the thigh; the edges are spread out so as to cover in all the dressing; the apex is pushed between the patient's skin and the belt, then folded down and secured with a safety pin (Fig. 47).

There are many other applications of this form of bandage figured by Esmarch in his *Surgeon's Handbook.*

CHAPTER XXI.

SPECIAL BANDAGES (CONTINUED).

BANDAGES FOR UPPER EXTREMITY. — *Bandage for Thumb* is simply a figure-of-eight, the turns going alternately round the ball of the thumb and the wrist till the whole of the former is covered in.

Bandage for Fingers.—It is rarely necessary to bandage each finger separately. In doing so, however, the ordinary spiral bandage is employed, the end being fixed by a figure-of-eight turn round the wrist. When all the fingers require to be covered in, it is better to pad them carefully, and apply a single bandage to support all of them together, than to apply a bandage to each individually.

To Bandage the Hand and Forearm, place the limb in the position of pronation, that is with the palm turned towards the ground, so that it corresponds in position to the sole of the foot. The other parts of the upper extremity will then correspond to those of the lower. Thus the hand represents the foot, the wrist the ankle, and the forearm the leg. The forefinger corresponds to the great toe, the little finger to the little toe, and the thumb to the heel. Applying the general rules, and employing the appropriate form of bandage, the hand and forearm are covered in exactly the same way as the foot and leg were. The thumb is left free (Fig. 48).

Fig. 48.

As in the lower extremity, so here, the *whole limb* may be covered in by continuing the above bandage in the form of a figure-of-eight over the elbow, of a simple or reversed spiral as

may be necessary over the upper arm, and finishing with a spica round the shoulder.

To Bandage a Closed Fist, e.g. in treating fracture of the metacarpal bones by a pad in the palm of the hand, the best means is by a series of figure-of-eight turns. The hand being closed and pronated, a fixing turn is made round the wrist, and then a series of figure-of-eight loops are applied alternately round the wrist and the hand, passing from the little finger towards the index. To finish off the bandage a turn is made circularly round the hand, and this catches in all loose pockets.

Bandages for Elbow.—The most convenient form of bandage to employ here is the figure-of-eight or spica, which may be either *convergent or divergent.* The former is simply a figure-of-eight, the turns converging towards the tip of the elbow ; the latter is applied in exactly the same way as the corresponding bandage for the knee. Begin over the internal condyle, making the first turn cover in the tip of the olecranon process. The pockets left above and below are disposed of by the succeeding diverging turns. Such bandages are used to keep the elbow joint at rest after operations or injuries, the converging spica being specially useful in cases of fractured olecranon, as it tends to approximate the fragments.

Bandage for the Shoulder.—Again the spica is used, the turns being alternately round the arm and the chest. It is not permissible to put the second turn of the spica round the neck in place of the chest, because the movements of the patient's head inevitably relax these turns and the bandage becomes inefficient. To apply this bandage continue that of the upper arm as far as the axilla, then pass over the shoulder from within outwards, across the back into the opposite axilla, thence across the front of the chest and round the shoulder to the point of starting. By three or four such turns, proceeding from below upwards, the whole shoulder may be covered in by an ascending spica. The descending spica is rarely, if ever, indicated in the region of the shoulder.

HANDKERCHIEF BANDAGES FOR UPPER EXTREMITY.—*For the Hand.*—A useful temporary bandage to retain a

dressing on the *palm of the hand* is obtained by folding a triangular bandage *en cravatte*, laying the centre over the palm, carrying the ends across the back and then round the wrist, on the back of which they are tied. This obviously consists of a double figure-of-eight. This bandage reversed would retain a dressing on the *back of the hand.*

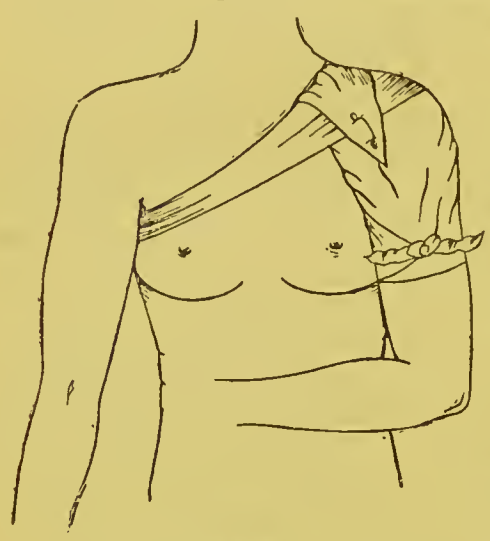


Fig. 49.

The *whole hand* may be covered in the same way as the foot.

For the elbow, the same method is adopted as for the knee.

For the shoulder, as for the hip, two bandages are required. The extra one is passed across the chest, passing under the opposite axilla (Fig. 49).

SLINGS.—These are used to support different parts of the upper extremity, and are in the form of triangular handkerchiefs. In applying a sling the base of the triangle is placed towards the part to be supported, the elbow, wrist, or hand, as the case may be. The ends are carried across the shoulders, either directly or crossed, and fixed by a reef knot, and they alone bear the weight, the apex being folded up neatly and fixed by a safety pin.

To Bandage a Stump.—Fix on the dressing by means of a few spiral turns, and then cover in the end of the stump by a series of divergent folds carried over the face of the stump so as to give support to the long flap, these being secured by a second set of spiral turns.

A *handkerchief* may be used for this purpose, as for almost any other.

The Many-tailed Bandage of Scultetus is used when frequent dressing of a part is necessary, and where it is at the same time undesirable to disturb the limb. It consists of a firm backbone, to which are sewn at right angles a number

(16 to 20) of shorter pieces. These are made to overlap one another for two-thirds of their width, and are long enough

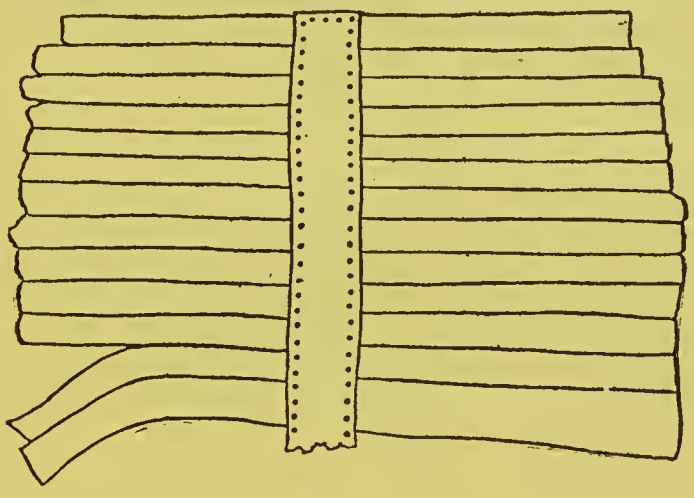


Fig. 50.

to encircle the limb once and half. The backbone is placed along the posterior aspect of the limb, the dressing applied, and the lowest turn folded into position, and successively all the others. The last turn is fixed by safety pins. As often as is necessary the turns may be unfolded, and the dressing re-applied without the limb being in any way moved (Fig. 50).

BANDAGES FOR THE TRUNK.—*Bandages for Mammæ.*—The ascending spica is the form of bandage selected, the object being, as a rule, to give support in cases of inflammation and suppuration of the breast. Supposing the *left* mamma to be the one affected, place the tail of the bandage against that side of the chest just below the breast, carry the bandage towards the right, and go round the body. As you reach the starting point catch in the tail, and elevating the inflamed gland with the palm of the hand, carry the bandage

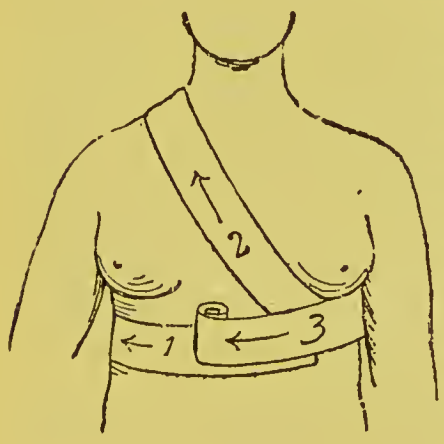


Fig. 51

across the chest, so that it will take the place of the supporting hand. Pass over the right shoulder and across the back to the starting point, thus completing the first figure-of-eight. Similar turns are applied, each going higher than the one preceding it, till all the mamma is covered in and supported (Fig. 51).

In cases where both breasts are the seat of inflammation, two such bandages should be applied separately, rather than the double spica in which the pressure on one side is directed from below upwards, and on the other in the opposite direction. This—the double spica—is rarely, if ever, indicated in preference to two single bandages.

Bandage to Retain Dressing after Excision of the Breast.—As this bandage is first applied while the patient is still only semi-conscious from the anæsthetic, it will be described as she lies on her back in bed. Suppose the right breast to be the one removed, and that the necessary dressing has been applied and the arm flexed to a right angle and placed across the front of the body. Protect the sound breast, especially if it be pendulous, by a layer of wool, and also the axilla. Begin the bandage by laying the tail over the sound breast, and carry it across the dressing to pass over the right arm just below the shoulder. Pass under the back to the point at which it started and there catch in, and so fix the tail of the bandage. Another turn is made round the body at a slightly lower level than the first, and continued across the front as far as the affected elbow. At this point the direction is changed, and the bandage is made to travel across the back to the left shoulder, in doing so supporting the right elbow. It then goes obliquely across the front of the body to the right elbow, round the tip of it, and thence up along the back of that arm to the shoulder, after crossing which it runs across the chest obliquely from right to left, thus making a St. Andrew's Cross with the previously made oblique turn. Passing to the back, and there also making a St. Andrew's Cross by running to the right shoulder, a turn is carried down the front of the affected arm, corresponding to a similar turn already made along the back of it. Looping round the elbow once more, a turn goes across the back to

the left shoulder, and thence vertically down to the lower margin of the dressing on that side, where the bandage ceases. Pins are inserted liberally at all the points of in-

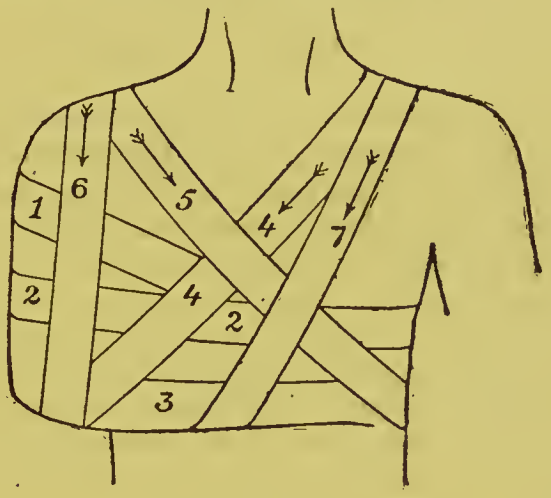


Fig. 52.

tersection, and thus is secured a very efficient mammary bandage. Such a bandage may, of course, be used for any other condition in which it is necessary to fix the upper extremity (Fig. 52).

CHAPTER XXII.

SPECIAL BANDAGES (CONTINUED).

BANDAGES FOR THE HEAD.—In applying bandages to the head it is well to make use of the various prominences of the skull as fixing points to prevent the bandage slipping. The chief projections useful in this way are (1) *the external occipital protuberance*, which is situated at the back of the head close to where the head joins the neck. It is always a well-marked elevation, and a bandage placed below it will be effectually prevented from slipping upwards; (2) *the parietal eminences* which are placed right above the ears on the side of the head. They vary greatly in size in different persons, but are always sufficiently prominent to fix a bandage placed between them and the upper edge of the ear, and prevent it slipping upwards; (3) the *ear* prevents any downward displacement; (4) *the superciliary ridges*, or upper margins of the orbit on which the eyebrows are placed, prevent the downward displacement of the turns passing round the forehead, while (5) *the frontal eminences* or prominences of the brow equally prevent their passing upwards.

The *divergent spica* is the type of bandage chosen for covering in the head, and in applying it three sets of turns are made: (1) A *horizontal* set, which pass *round* the head above the level of the ears, being fixed in position by the anatomical points just mentioned, behind by going below the occipital protuberance, and in front between the ridges of the eyebrows, and the prominences of the forehead. (2) A *coronal* set, which travel across the crown of the head from side to side, and under the chin. These turns sometimes pass in front of the ears, sometimes behind them, depending on the part of the head which is being covered in. If the front part, then they go behind the ears so that the turns will be prevented from slipping forward; if the back part, then of course in front of the ears. (3) To fix the

horizontal and coronal turns a single loop is made from behind forwards, and to it the others are pinned. This turn is not absolutely necessary, but it makes the bandage look neater, and if properly applied, gives additional security. At the crossings of the different turns safety pins are inserted, or they may be stitched together with a needle and thread.

To Bandage the Fore Part of the Head (Fig. 53).—Grasp the loose tail of the bandage in the left hand leaving about a foot of the bandage free. (1) From the left ear carry a turn *horizontally* round the head, (2) and on reaching the starting point let the head of the bandage pass *under* the loose tail. The next turn is to go *vertically* round the head, *i.e.* across the crown and under the chin. (3) These two turns fix the bandage. Now begin the divergent spica by making a turn pass across the middle of the front part mapped out, (4) and from this let succeeding turns diverge till all is covered in. The loose tail is used as a fixed point round which all the turns are twisted. It will be seen that only one turn goes under the chin, the others going horizontally round the head. The antero-posterior turn is now made by carrying a turn from the occipital protuberance forward to the root of the nose, and to this turn all the others are pinned or stitched.

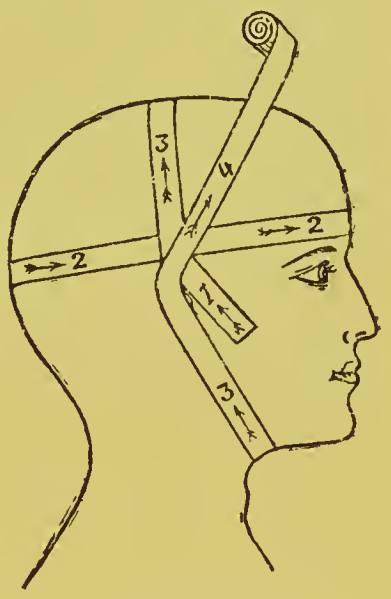


Fig 53.

To Bandage the Posterior Part of the Head.—The divergent spica is here also selected as the type of bandage, but on account of the shape of the head greater difficulty is experienced in preventing the turns slipping. Turns must be made round the chin or forehead as is found necessary to give security to the bandage.

To Cover in the Whole of the Head.—The *Capeline or Double-headed Roller* is a very secure bandage for this pur-

pose, but it has the great disadvantage of heating the patient's head too much, and on this account is seldom used. To apply it, begin by sewing together the tails of two ordinary six-yard bandages. As one of the bandages should be somewhat longer than the other, roll about a yard or a yard and a half of one bandage on to the other. The shorter of the two bandages is to repeatedly traverse the head antero-posteriorly, while the longer goes round and round the head, fixing in the antero-posterior turns. Stand behind the patient, who should be seated on a chair, and holding the larger roller in the left hand and the smaller in the right, begin by placing the bandage across the forehead, just above the root of the nose; carry both rolls to the back of the head, and then change hands, letting the smaller one pass under the larger, and so be fixed by it. Here the first antero-posterior turn is made by passing from the occiput forward across the centre of the head to the root of the nose, where the circular turn catches it in. From this mesial turn the succeeding ones diverge first on one side and then on the other, being fixed always in front and behind by the circular turns till all the head is covered in. By diverging slowly and coming well down in front and behind a very firm bandage will be applied. Pins or stitches may be inserted here and there to add to its security.

The *Four-tailed Bandage* (Fig. 54) for fracture of the lower jaw consists of a piece of bandage about a yard long split longitudinally, save for a short distance near the middle. In the centre of the unsplit portion a small diamond-shaped slit is made, and into it the tip of the chin is placed. The two anterior tails are carried backwards and fixed above the occipital protuberance, while the posterior ones are tied over the crown of the head. The ends of these two turns are now tied together to prevent slipping. If properly applied the patient should have difficulty in opening his mouth.

Fig 54.

Handkerchief Bandages for the Head.—These are particularly useful because of their lightness, their ease of application, and their security.

(a) A triangular bandage is laid over the top of the head, so that the base passes straight across the forehead, the apex lying over the occiput. The ends are gathered up and carried to the back of the head, where they cross below the occipital protuberance, and then pass above the ears to the front, and are there tied. The apex is turned up over the occiput, and fixed with a safety pin.

(b) Esmarch describes a "four-tailed bandage" for the head as follows: "A rectangular cloth, 24 inches long, 8 inches wide, split at both ends like a split compress. To secure a dressing to the top of the head with this cloth, the two posterior ends are to be tied under the chin, and the two anterior ends under the occiput. On the other hand, to secure a dressing upon the occiput, the anterior ends are tied under the chin, and the posterior across the forehead."

(c) A large square head cloth is also used by the same surgeon.

SECTION IV.—SURGICAL INSTRUMENTS AND APPLIANCES.

CHAPTER XXIII.

GENERAL INSTRUMENTS.

THE different tastes of surgeons, and the large variety of tools at their disposal, render it impossible to lay down hard and fast rules as to what instruments are to be laid out for a given operation. This can only be done by one who has a knowledge not only of the steps of the operation, but also of the complications and emergencies which may arise during its performance. In arranging for an operation, it is advisable that every instrument which, by any chance, may be required, should be carefully selected and sterilised by being subjected to a high temperature, either by boiling in water or carbolic lotion, or by steam.

Perhaps the best and most convenient steam steriliser is that devised by Mr. C. W. Cathcart of Edinburgh, which is practically a water-bath, with an arrangement by which the steam generated in the space between the walls may be introduced to the inside chamber. To prevent rusting of the instruments, they are heated to the boiling point before the steam is admitted, and so condensation does not take place on them; and in addition, the carbonic acid gas which is essential to the process of rusting, is driven off in heating the inner chamber.

The instruments are transferred *directly* from the steriliser to shallow porcelain or metal trays containing 1 in 20 carbolic, in which they lie till required, covered over with a carbolised towel. The bottom of the tray in which the knives lie should be covered with a sheet of india-rubber or lint to protect their edges.

The *instrument clerk* must carefully purify his hands and

arms before handing up the instruments to the surgeon; and on receiving them back he should clean off all blood or pus with a swab of wool before replacing them in the tray. This is especially necessary in the case of serrated instruments such as artery-forceps, saws, etc.

After the operation the instruments are steeped in a solution of soda, scrubbed with a nail brush, dried and replaced in the drawer.

GENERAL INSTRUMENTS.—The following should be in readiness at almost every surgical operation :—

(1) *Dressing Scissors.*—Various patterns are used, *e.g. round pointed* (Fig. 55), *probe-pointed* (Fig. 56), or *elbow-curved* (Fig. 57).

Fig. 55.

Fig. 56.

Fig. 57.

(2) *Probes.*—These are used for various purposes, chiefly to explore sinuses to detect their extent, direction, and contents. They should only be employed when the finger of the surgeon is not available, either on account of the small size or great depth of the sinus, as no information derived by the use of the probe is to be compared in value to that given by "the educated finger." This applies especially to such conditions as scalp wounds, where it is of great importance to ascertain the condition of the bone, and where the wound in the soft tissues may sometimes be enlarged rather than trust to the probe as a diagnostic agent. The ordinary short silver probe (Fig. 58) supplied

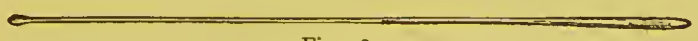


Fig. 58.

in every pocket case is the type of this instrument. It is

about six inches long, rounded, with a slightly bulbous point at one end, and at the other flattened out and furnished with a large needle-eye. Being of silver, it may be made to take any shape desired.

The Gun-shot Probe, as its name implies, is used to follow up the track of a bullet. It is about twice as long and as thick as the smaller probe, but otherwise identical with it.

For the same purpose Nélaton introduced his *bullet probe* furnished with a small porcelain head, on which a black mark is left by the lead, and thus any source of error such as might arise by touching bone or other hard substance is eliminated.

Spiral Probes, made of a fine continuous steel wire, have been used to follow up the sinuous track of a bullet, but their utility is limited, and the difficulty of keeping them aseptic is a great disadvantage.

(3) *Directors* are narrow, blunt-pointed instruments about six inches long, furnished with a deep groove down the centre, along which a bistoury may be passed, and the extent and direction of an incision thus be accurately determined. The *ordinary director* is used in opening up a sinus, or in opening an abscess by Hilton's method. At one end it is hollowed out so as to form a blunt spoon or scoop.

Spence's Hernia Director, used to guide the knife to the constricting band in the operation for strangulated hernia, is about three times as broad as the ordinary director, and the groove is not so deep.

Key's Hernia Director (Fig. 59) is also broad, with a

Fig. 59.

shallow groove, and in addition has a distinct curve on the blade. *A German-silver director*, probe-pointed, is sometimes used to guide the knife in slitting up a fistula-in-ano.

(4) *Dressing Forceps* are of various patterns, some resembling artery forceps, but without the catch on the handles. Others resemble polypus forceps, but are serrated only half-way up the blades.

(5) *Sinus Forceps* (Fig. 60) have long, narrow, tapering blades, serrated at the point for a very short distance. They are used to pick out small substances, such as fragments of dead bone from a narrow, deep sinus, or for introducing drainage tubes into a deep wound, care however being necessary lest the sharp points damage important structures. They also serve to introduce small fragments of silver nitrate into the bottom of long sinuses which refuse to heal.

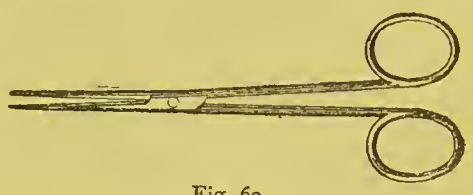


Fig. 60.

(6) *Dissecting Forceps* (Fig. 61) are very often required at operations.

Fig. 61

(7) *Retractors* are used to separate the lips of a wound during an operation, to hold aside, and so remove from danger important structures, such as large vessels or nerves, or to steady a tumour while being dissected out. The simplest form of retractor is a short, broad sheet of copper which may be bent so as to form a hook of any size. Another is made of wire, which will also bend to any desired angle. Various forms of steel hooks are also used, the best of which perhaps go by the name of

Fig. 62.

Ollier (Fig. 62). They are made in sets of different sizes, and have several blunt teeth.

(8) An ordinary *Razor* is very often required to shave the part to be operated on.

(9) An *Aneurism Needle* (Fig. 63) should always be in

Fig. 63.

readiness. It is a blunt-pointed, curved needle, mounted on a handle, and is used to pass a ligature round a blood-vessel, as well as for other purposes.

(10) *Needles* are employed to sew up wounds, whether made by accident or by the knife in the course of an operation. Some surgeons prefer a straight needle, which differs from an ordinary sewing needle, in having the blade somewhat flattened from side to side, and the eye considerably larger. Many use the half-curved needle, while perhaps the most frequently employed is the curved needle, on ac-

Fig. 64.

count of the greater ease and rapidity with which sutures may be inserted by it (Fig. 64).

(11) *Needle Holders* are, as a rule, dispensed with by ordinary surgeons, but by some they are found to be of advantage, and many patterns have been introduced, characterised, however, more by the ingenuity of their mechanism than by their practical utility. Some are made to be used with any form of needle, *e.g.* Fig. 65, which represents a pair of dressing forceps, which may also be used as a needle holder, being adapted with a longitudinal groove into which the needle fits. Figs. 66 and 67 represent two forms of needle holder used by ophthalmic surgeons. The Hage-

dorn needle holder can only be used with the flat-bladed needles employed by that surgeon.

Fig. 65.

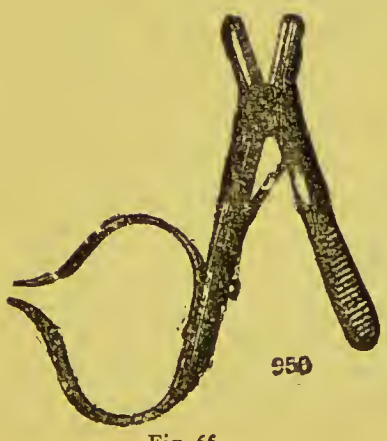


Fig. 66

Fig 67.

CHAPTER XXIV.

INSTRUMENTS FOR HÆMORRHAGE.

INSTRUMENTS USED TO PREVENT HÆMORRHAGE.—(1) *Tourniquets—(a) Esmarch's Tourniquet for the bloodless operation* consists of two parts—a strong elastic bandage and a thick piece of elastic tubing, fitted at one end with a few chain links, and at the other with a hook, by means of which it is secured. The elastic bandage is applied tightly round the limb from below upwards, to drive all the blood out of the vessels. At the upper limit, just above the seat of amputation, the powerful tubing is fixed, and so prevents the entrance of blood into the part on the removal of the bandage. The tubing should be applied over a few turns of *wet* cotton bandage, to prevent injury to the skin or slipping of the tourniquet. By this means the part to be removed is rendered absolutely exsanguine, and not only does the patient lose no blood at the operation, but after it he has proportionately more blood in his body than he had before. The disadvantage of this instrument is that it cannot be slackened gradually to ascertain if all vessels have been tied, as with Petit's screw tourniquet.

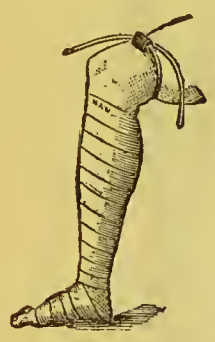


Fig. 68.

(b) Foulis' Elastic Tourniquet (Fig. 68) consists of a piece of strong india-rubber tubing about two feet long, and furnished with a simple catch. The tube is stretched and passed once or twice round the limb and then fixed into the catch. The limb should be elevated for a few minutes to allow it to become devascularised, a turn or two of moist bandage *loosely* rolled on, and over this the tourniquet rapidly and tightly applied. It is important to put on the tourniquet quickly and firmly, because by so doing you cut off all the blood going into the part as well as the venous return, and so attain the object of a tourniquet,

otherwise the venous current is stopped, while the more forcible arterial flow goes on, and the tourniquet becomes a means of engorging rather than of emptying the limb. With Foulis' tourniquet the vessels when cut do bleed a little, but this is to some extent an advantage, as it enables the surgeon to see and secure them before removing the tourniquet.

Fig. 71.

(c) Petit's Screw Tourniquet (Fig. 69) is more complicated in construction than the others, but equally simple in principle. It consists of a metal frame of two plates perforated by a screw, and threaded through these is a strong inelastic belt fitted with buckles, and a pad to go over the main artery of the limb. One or two points must be attended to in fitting up this instrument. (1) To ensure that the band is properly threaded into the brass plates it must pass twice through each outer division in the under plate, and not at all through the inner division. If properly threaded, no brass is visible on the under surface of the instrument, while if wrongly done the inner bar on each side is seen. (2) Be careful before beginning to thread the tourniquet that the buckle is turned so that it will catch when placed on the limb. (3) Approximate the two plates before beginning to apply the instrument. This tourniquet is also applied over a turn or two of moist bandage, and the pad is placed over the main blood-vessel of the limb, so that when the screw is brought into action the blood supply will be cut off as thoroughly as possible. The great advantage of Petit's instrument over most others is that it may be slackened gradually, and so any vessels which have escaped the surgeon may be seen, the screw tightened again, and these tied without undue loss of blood to the patient.

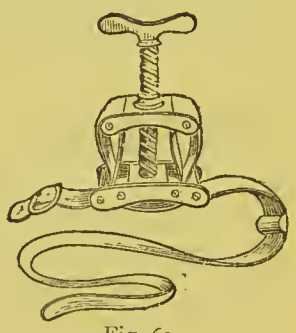


Fig. 69.

Fig. 70.

(d) Elastic Webbing of any sort may be used as a tourniquet, being put one layer over the other. The point of importance being to apply the first turns rapidly and very tightly.

(e) Lister's Tourniquet (Fig. 70) is for compressing the abdominal aorta.

(f) Davy's Lever (Fig. 71) is used to compress the aorta and iliac arteries through the rectum, but is a dangerous instrument to use.

INSTRUMENTS FOR THE ARREST OF HÆMORRHAGE.—Of the older instruments used to arrest hæmorrhage may be mentioned the *Tenaculum* (Fig. 72),

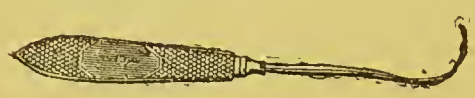


Fig. 72.

a sharp-hooked instrument with a wide curve, with which the bleeding artery is transfixed and pulled out of its bed while a ligature is applied.

Assilini's Forceps, a sort of double tenaculum, acting with a spring, are seldom if ever used now.

Torsion Forceps (Fig. 73) are employed to seize and then to twist arteries. This method of arresting hæmorrhage was first prominently advocated by Mr. Bryant, who has employed it very largely in his practice. The forceps have flat parallel finely-serrated blades, secured by a sliding catch; they are applied either in the line of the divided vessel, or better, at right angles to it, and then turned five or six times round, so as to rupture the inner coat of the vessel, and so arrest the flow of blood. They should be left on for a few minutes after twisting till the clot has fairly formed inside the vessel.

Fig. 73.

Liston's Catch Forceps (Fig. 74) in shape resemble ordinary dissecting forceps, but they are furnished at the point with sharp teeth, which interlock, and in the middle with a spring catch, by means of which they retain their hold on a vessel, and so may be left for some time. The ligature should be

Fig. 74.

applied well above the point at which the vessel is seized, especially if it be a large trunk, as bleeding is apt to take place from the wound in the vessel-wall made by the forceps.

A modification of these forceps by Wakley has the blades broadened out and fenestrated, so that the point becomes conical, which facilitates the application of the ligature.

Pean's Forci-pressure Forceps (Fig. 75) differ from those

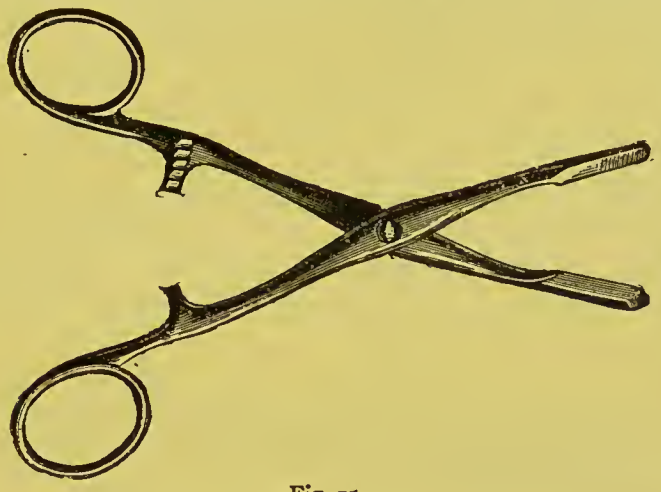


Fig. 75.

of Sir Spencer Wells only in having the blades separable (for purposes of cleanliness), and in having the joint about half-way down the blade. These forceps are more apt to spring off the vessel when left hanging than those of Wells', otherwise they are equally good.

Spencer Wells' Forci-pressure Forceps are perhaps the most generally used instruments for the arrest of hæmorrhage. They have the advantage of being very readily applied, and of holding securely even large vessels. If left on for a few minutes, the pressure exerted by them arrests bleeding from smaller arteries; they may be used as torsion forceps; or a ligature may be applied according to the taste of the surgeon.

Various forms of small portable instruments have been devised for applying to small bleeding vessels, but are not much used in hospital. Of these may be mentioned the *serre-fine*, or twisted wire forceps, chiefly used in France;

Dieffenbach's Bull-dog Forceps (Fig. 76); and *Maw's Artery Forceps* (Figs. 77 78).

Fig. 76.

Fig. 77.

Fig. 78.

Acupressure Needles were introduced by Sir James Simpson as a means of arresting hæmorrhage, but have been almost entirely given up.

CHAPTER XXV.

KNIVES.

THERE are very many forms of knives used in surgery, and we cannot attempt to do more than describe a few of the commoner and more generally useful of these. *Scalpels* (Fig. 79) are of various sizes and shapes, have a

Fig. 79.

short, broad blade, with a sharp point, and are chiefly used surgically in dissecting out tumours, etc., where very great care is necessary to avoid injuring important structures, such as blood-vessels and nerves.

Bistouries are somewhat like scalpels, but, on the whole, are longer, especially in the blade, which is narrow in proportion to its length. They are used in making long incisions in the skin, or in performing small amputations, such as fingers, toes, and so on. *Varieties* are indicated by their names, *e.g.* straight sharp-pointed bistoury (Fig. 80); straight probe-pointed bistoury (Fig. 81); curved sharp-pointed bistoury (Fig. 82); curved probe-pointed bistoury (Fig. 83). Those with probe points are used in parts where there is danger in introducing a sharp-pointed in-

strument, for example, in splitting up a long sinus near any large blood-vessel or other important structure.

Fig. 80.

Fig. 81.

Fig. 82.

Fig. 83.

Amputating Knives are of very various sizes and patterns, some having a single cutting edge (Fig. 84), others cutting

Fig. 84.

with both edges; some with sharp points, some rounded,

and so on, varying according to the operation and the taste of the operator. *Syme's Amputating Knife* (Fig. 85)

Fig. 85.

was used by that surgeon in performing his amputation at the ankle joint. It is a short, strong, broad-bladed knife, with a very thick back and a large handle, like other amputating knives.

Abscess Knives.—(1) *Syme's Abscess Knife* (Fig. 86) has a short, somewhat sickle-shaped blade, which is bevelled off at the sides. When thrust into an abscess, the point always tends to make its way to the surface again. (2) *Paget's Abscess Knife* (Fig. 87) consists of a thin, narrow, straight blade, attached to its handle by a thin metal stem. (3) *Von Graefe's Cataract Knife* (Fig. 88) is used by some in opening small abscesses. It is particularly suitable for children and nervous women, as its size does not alarm them.

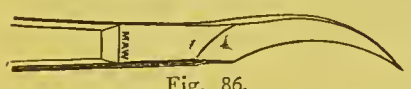


Fig. 86.

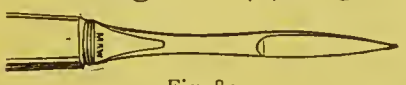


Fig. 87.

Fig. 88.

Tenotomy Knives (Fig. 89), as their name implies, are used for cutting tendons, the operation being done subcutaneously. They may be sharp or probe-pointed, are short,

Fig. 89.

thin, and narrow, and only cut with one edge. Of course, the probe-pointed knife can only be used after the skin wound has been made by the other. It is used as a protection against wounding blood-vessels, etc.

Special *Hernia Knives* are seldom used by most surgeons, a curved probe-pointed bistoury serving the purpose equally well. Their function is to divide the constricting band in cases of strangulated hernia, and for this purpose they are fitted with a long, curved, rounded stalk, about four inches long, having a very short cutting edge situated about an inch from the point, which is also blunt. On the back of the stem there is a rough area, by which the surgeon may determine exactly the position of the cutting portion of the edge when he is using it.

CHAPTER XXVI.

SAWS.

SAWS vary in size and shape, according to the particular part of the body in connection with which they are used.

The Ordinary Surgeon's Saw (Fig. 90) is used in dividing

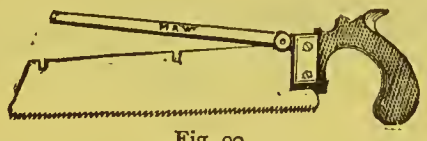


Fig. 90.

bones, *e.g.* in an amputation of a limb. The blade is broad, the handle resembles that of a joiner's saw, and as a rule the back is made movable, so as not to interfere with the onward movement of the blade through a thick bone.

Metacarpal Saws (Fig. 91) are of various patterns, some

Fig. 91.

bow-shaped, some short and broad (Fig. 91), and others long and narrow. As the name implies, they are used to divide smaller bones, such as metacarpals or metatarsals.

Finger Saw (Fig. 92) is still smaller, and is used to cut through the phalanges.

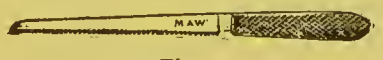


Fig. 92.

Butcher's Saw, called after the surgeon who introduced it, consists of a narrow steel blade with fine teeth, set in a framework of metal in which it can be turned so as to work in any direction, and from which it may be readily

detached. It is chiefly useful in excising joints, the narrow blade permitting of the bone being sawn in a direction away from the blood-vessels.

The Bow-Shaped Saw (Fig. 93) possesses some, but not all, of the advantages of Butcher's.

Fig. 93.

A *Chain Saw* (Fig. 94) is sometimes used for dividing

Fig. 94.

the neck of the femur, round which it is passed by the aid of a specially-curved needle.

Adam's Saw is used specially for the operation of subcutaneously dividing the neck of the femur, introduced by that surgeon. It consists of a long rounded stem, the terminal part only of which is serrated, and a large handle like that of an ordinary amputating saw.

CHAPTER XXVII.

INSTRUMENTS USED IN CONNECTION WITH OPERATIONS ON BONE.

Probes are always necessary in such operations (page 131).

Periosteum Separators or Elevators are very often

ig. 95.

employed in operating on diseased bone, their use being indicated by their name. They are of various shapes, but all agree in having a blunt edge and a strong handle, the former to peel off the periosteum, the latter to give the necessary leverage. The pattern used by Professor Macewen, of Glasgow (Fig. 95), is of very general utility, affording great leverage, and taking up a small amount of room.

Forceps.—(a) Necrosisor Sequestrum Forceps (Fig. 96) are used to extract pieces of dead bone—sequestra—from a wound or sinus. They have an ordinary scissors joint, have rough gripping points, and require to be of considerable strength. They may be straight or curved.

Fig. 96.

(b) Lion Forceps (Fig. 97) originally used by Sir William Fergusson in excising the upper jaw, may be employed in almost any condition in which it is necessary to get a very firm grip of a piece of bone. The blades beyond the joint are more curved than those of necrosis forceps, and each

Fig. 97.

terminates in four strong teeth, those of the two blades being opposed.

(c) Gouge Forceps (Fig. 98) are used to remove fragments of bone piecemeal, rather than complete sequestra. They practically consist of two gouges united so as to form forceps, and are exceedingly powerful. The edges are sharp, so that even hard bone may be readily pared down by them. Like others, they are made curved as well as straight.

Fig. 98.

(d) Bone Forceps, or *Bone Pliers* (Fig. 99), are cutting instruments, and are used under various conditions, where

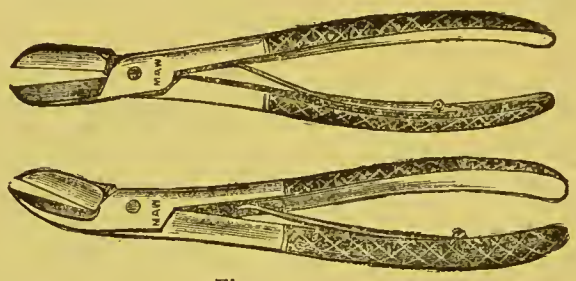


Fig. 99.

bones require division, taking the place of the saw in small amputations, such as fingers or metacarpals.

Chisels (Fig. 100) are used either to chip away portions of bone, or to divide a bone completely through, the size and shape of the instrument varying, of course, according to the purpose for which it is employed.

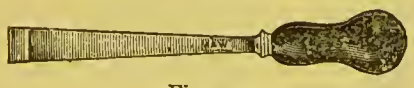


Fig. 100.

The most powerful and generally useful form of chisel is that introduced by Macewen, of Glasgow, for his operation of osteotomy, and hence sometimes called *Macewen's Osteotome* (Fig. 101). The whole instrument, blade and handle, is of one piece of metal; the blade, wedge-shaped, is bevelled equally on both sides, and must be of the best steel,

Fig. 101.

It is graduated on the side to ensure accuracy in dividing the bone.

Fig. 102.

Gouges are used to chip away pieces of bone, diseased or otherwise, or in opening the skull in some cases. They are simply chisels with grooved blades, and are of various sizes.

Trelat's Gouge is straight, with a long metal handle; while some others have ebony handles.

Mallets are used along with the gouges or esteotomes. They may be of steel or of wood.

Gimlets are used in surgery to pierce bones preparatory to wiring fragments together, *e.g.* after fractures, and they should have an eye near the point, so that they may carry the wire through.

Sharp Spoons or Scoops.—These are often found useful in dealing with sinuses associated with diseased bone, and even in scraping the bone itself. They were originally used by Volkmann, and usually bear his name (Fig. 102). In some the spoon is round, in others oval, and the edges are just sufficiently sharp to remove diseased tissue, sparing that which is healthy. Preferably, the whole instrument is made from one piece of metal, so that it may be sterilised by heat without being damaged. This is the more necessary, as the sinuses and cavities in which it is employed so often swarm with septic and other organisms, that there is danger unless great precautions are taken. *Lister's Spoon* (Fig. 103) is a much shorter and stouter instrument, but otherwise resembles that of Volkmann. Other sharp spoons, much smaller than the above, are used in the treatment of lupus, where it is necessary to scoop out the contents of each tubercular nodule. These are sometimes called *lupus curettes.*

Fig. 103.

Drills are used to perforate bones preparatory to pegging or wiring fragments.

CHAPTER XXVIII.

TREPHINING.

Instruments used in Trephining the Skull.—The operation known as trephining or trepanning the skull consists in the removal of a circle of bone from the vault, in order to obtain access to the contents of the cranium, or to facilitate the elevation of depressed fragments when the skull has been fractured. The instruments used in the successive steps of the operation are these :—(1) A razor of the ordinary kind, with which to shave the region of the head to be operated upon ; (2) a scalpel, or small bistoury, to make the incision through the tissues overlying the bone ; (3) a periosteum separator, with which to raise the pericranium, as the covering of the skull bones is called ; (4) blunt hooks to retract the edges of the scalp wound ; (5) dissecting forceps ; (6) artery forceps (Wells' or Pean's) will be needed to secure the blood-vessels cut in making the scalp incision. (7) *The Trephine* is the instrument used to saw out the bone circle. It consists of a small round saw, varying in diameter from $\frac{1}{4}$ to one inch, mounted on a strong hollow metal shaft, about $3\frac{1}{2}$ or 4 inches long, to which is attached at right angles a thick, strong handle. Running down through the hollow of the shaft is a movable centre-pin, which may be made to project beyond the level of the saw teeth, or be entirely withdrawn, as required. It is fixed in the desired position by a screw on the side of the shaft. In some instruments only the free edge of the blade is serrated, *e.g.* Fig. 104, and in others the serrations are carried along the outer aspect of the blade. In

Fig. 104.

using the trephine, the centre-pin is first projected from 1-16th to 1-8th of an inch beyond the level of the saw, and there firmly fixed. The point of it is then pressed into the centre of the area of bone to be removed, and in this way the saw is steadied until it has made a groove for itself in the bone. So soon as this has been accomplished the centre-pin is completely withdrawn, lest it should interfere with the onward progress of the saw, or, perforating the bone before the saw, injure the membranes of the brain underneath. The saw is then gradually worked through the bone with a rotatory motion, as in using a bradawl, great care being necessary on account of the fact that the skull is not of the same thickness all over, and there is consequently a danger of one part of the circle being through early, and of the saw opposite that part damaging the membranes. To prevent such an accident the trephine must be frequently removed and the groove

Fig. 105.

Fig. 106.

Fig. 107

measured all round. This is most conveniently done by an ordinary toothpick, blunted at the point, which also serves to remove the bone dust from the groove. (8) The

bone being sawn through all round, the circle has now to be lifted out, and for this purpose the *Trephine forceps* (Fig. 108) are employed. These are made on the same principle as dissecting forceps, but the blades are rounded so as to adapt themselves to a curved object. (9) An instrument called the *Lenticular* (Fig. 106) is sometimes used at this step of the operation to plane the edges of the hole in the bone. It has a stem with sharp edges which scrape off any projections, and these fall into a small basin-shaped button at the foot. It is not often used. (10) When the operation is performed for fracture of the skull, it is often necessary to saw off projecting ledges of bone, and this is done by means of *Hey's Saw* (Fig. 107), which consists in two small saws of different shapes fixed on to a long, strong handle. (11) Another instrument also used in cases of fracture is the *Elevator* (Fig. 105), which is used to raise any depressed fragments of bone which are pressing on the subjacent brain. It is to be distinguished from the periosteum separator, being roughened on one aspect to prevent it slipping from under the bone. (12) The other instruments used in the operation will depend on the object for which it is being performed, *e.g.* the removal of a tumour or foreign body, the evacuating of an abscess, or the elevation of depressed bone. In all conditions, as asepsis is the key to success, the greatest care must be taken in the purification of instruments, hands, dressings, etc.

Fig. 108.

CHAPTER XXIX.

INSTRUMENTS FOR MOUTH.

Tongue Depressors are employed very frequently, and in quite simple procedures. When examining the condition of the fauces or pharynx, the tongue is very apt to become arched, and obstruct the view, and such a depressor as that figured in (Fig. 109) is used to keep it down. The instrument is of electro-plated metal, consists of two blades of unequal size, united by a hinge joint. Another form of instrument, *e.g.* that by Turch (Fig. 110) is more convenient when the tongue has to be held down for any length of time during an operation.

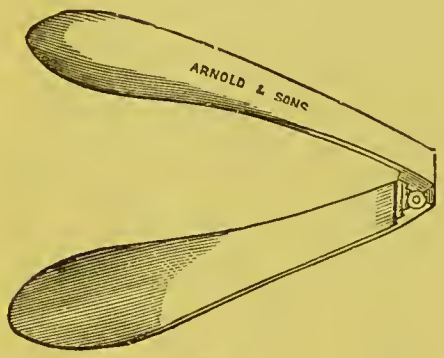


Fig. 109.

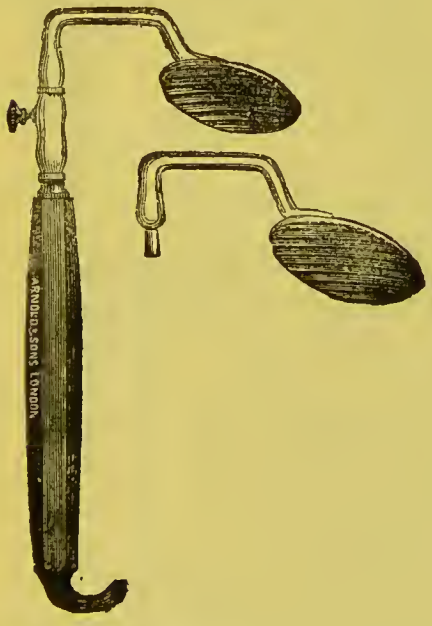


Fig. 110.

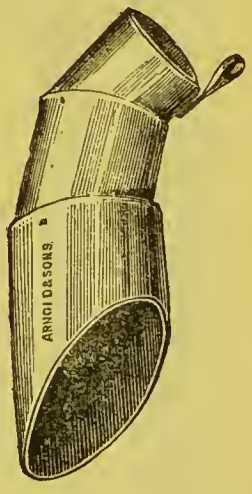


Fig. 111.

When manipulations are being carried out on the mouth and fauces, the finger of the surgeon is apt to be bitten, especially by children, and to prevent this the jointed finger protector (Fig. 111), which, at the same time, acts as a gag, may be worn.

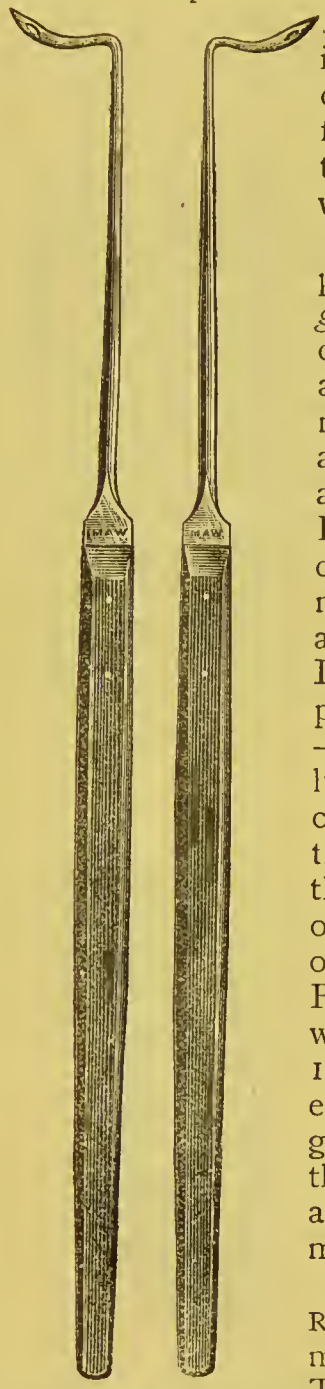


Fig. 113.

For keeping the mouth open during prolonged operations, various forms of *gag* are made use of, *e.g.* that introduced by Fergusson, which is single, and kept at the desired width by means of a screw-button working on a rod. Lister's gag is kept open by a steel ring sliding on the blades. It is double, the two ends being of different sizes. Smith's gag is a more elaborate instrument, being adapted for both sides of the mouth. It is used in the operation for cleft palate. In certain classes of patients —*e.g.* alcoholiacs and lunatics—it is often necessary to forcibly open the mouth, in order, in the first class, to wash out the stomach; in the other, to introduce food. For this purpose the wedge-shaped gag (Fig. 112) is employed. The edge of the wedge is gently inserted between the teeth, and then by a powerful screw the blades are gradually separated, and the mouth thus opened.

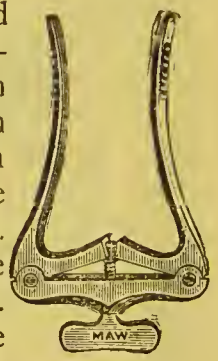


Fig. 112.

INSTRUMENTS USED IN THE OPERATION FOR CLEFT PALATE.—The mouth is kept open by Smith's gag. The *knives* used for paring the edges of the cleft are mounted on long handles, and have a rounded

metal stalk, the blade in some being at an angle with the stalk, in others straight. Many surgeons use an ordinary bistoury with a good long blade. The *needles* with which the stitches are passed are all more or less curved (Fig. 113). Some have only a single curve, while

Fig. 114.

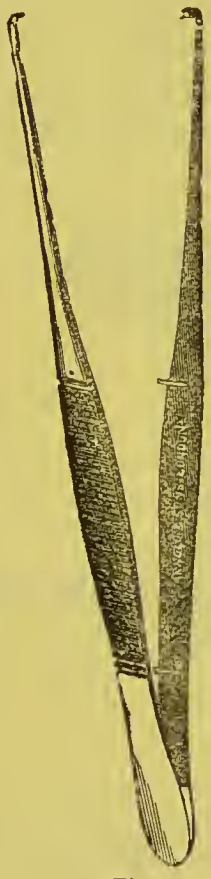


Fig. 115.

Fig. 116.

others are double-curved, and are in pairs, right and left. *Raspatories* or *separators* (Fig. 114) are used to detach the soft tissues from the bone in order that the edges may be approximated. Various forms of *forceps* are employed to seize the tissues as the stitches are being inserted and tight-

ened (Fig. 115). To sponge the parts, a *sponge holder* (Fig. 116) is found very useful. A small sponge is inserted between the toothed blades, and these are approximated by sliding up the ring.

Hare Lip Pins are used in the plastic operations for the remedy of this deformity.

INSTRUMENTS USED IN EXCISION OF TONSILS.—This simple operation can quite well be performed with an ordinary pair of vulsellum forceps and a curved probe-pointed bistoury (Fig. 83), part of the blade of which is protected by a piece of sticking plaster wrapped round it. Some surgeons, however, prefer a knife specially made for the purpose, the proximal end of which does not cut, and others use one or other form of tonsil guillotine. (Figs. 117, 118).

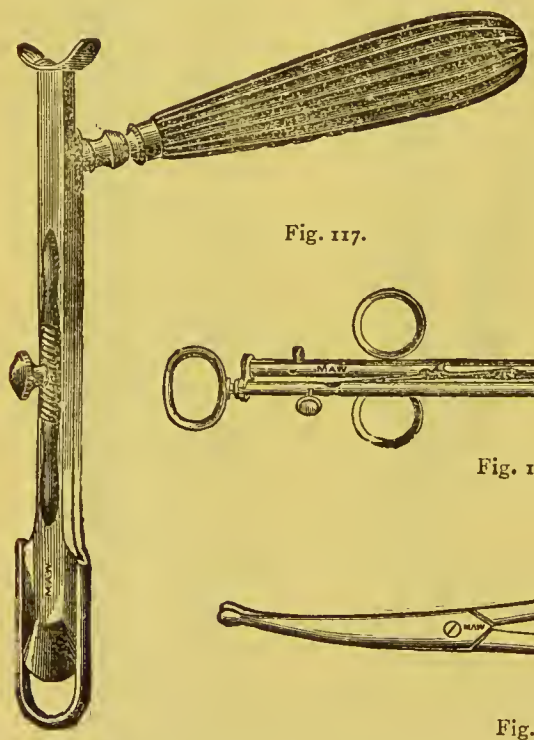


Fig. 117.

Fig. 118.

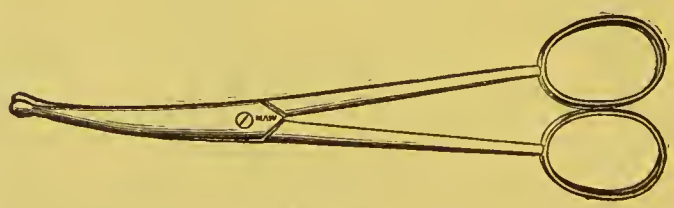


Fig. 119.

In removing the uvula, a gag, the vulsellum forceps, and a pair of curved probe-pointed scissors (Fig. 119) are necessary.

ŒSOPHAGEAL INSTRUMENTS.—Various forms and sizes

of *bougie* are used in the diagnosis and treatment of affections of the œsophagus. Some of these are of uniform calibre, and are made of soft gum-elastic. Others consist of olive-shaped balls, ivory or metal, fixed on to a whalebone rod, and graduated to a scale. A combined *probang* and *coin-catcher* is illustrated in Fig. 120. The *umbrella-probang* (Fig. 121) consists of a bunch of bristles, which is passed into the œsophagus, and then by a mechanical arrangement opened out, so that on being withdrawn it brushes any foreign body, such as a fish bone, out before it. For the removal of larger foreign bodies, *œsophageal*

Fig. 120.

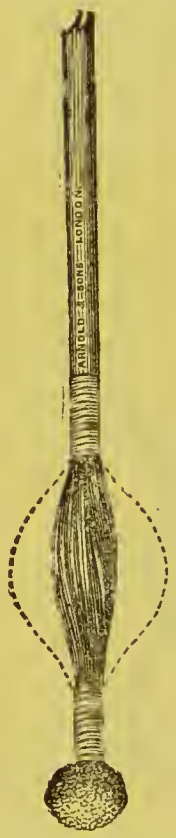


Fig. 121.

forceps of different patterns are employed, some opening laterally, others antero-posteriorly.

STOMACH PUMPS, ETC.—Numerous arrangements, such as that shown in Fig. 122, have been devised with which to wash out the stomach, but perhaps the simplest and safest is an ordinary soft rubber tube, fitted to a metal or vulcanite funnel, and acting on the syphon principle (Fig. 123). Such

Fig. 122.

Fig. 123.

an apparatus may also be used for feeding lunatics and others who refuse to swallow food, the tube for this purpose being passed either through the mouth or nose.

CHAPTER XXX.

INTESTINAL INSTRUMENTS.

In connection with operations for resection of intestine, various clamps are employed to occlude the gut above and below the diseased part. Of these, Makin's is perhaps the most convenient.

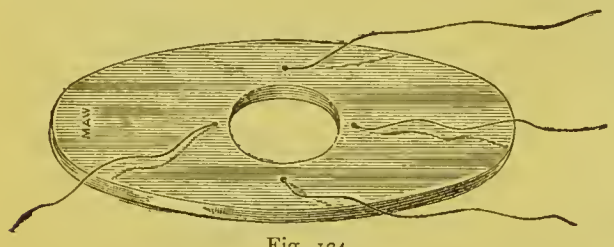


Fig. 124.

Senn's Bone Plates (Fig. 124) are used in this operation, to aid in approximating the severed ends of intestine.

Dupuytren's Enterotome is used to destroy the eperon formed in connection with an artificial anus.

Instruments and Appliances used in connection with Hernia.—In addition to the instruments used in other surgical operations, the *Hernia Knife* and the different forms of *Hernia Director* are required.

Macewen's Needles (Fig. 125) are used in the operation for the radical cure of hernia devised by that surgeon.

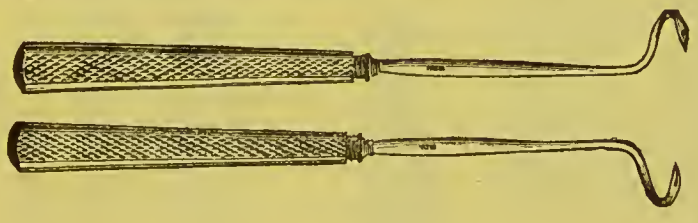


Fig. 125.

Trusses.—These are used to retain a reducible hernia in the abdominal cavity, and so to admit of closure of the opening through which it protrudes.

The commonest and most generally useful truss is that known as the *Circular* or *Spring Truss*, which may be adapted for one side or for both.

The truss should be applied before the patient gets out of bed in the morning, and should not be taken off till he has lain down at night In this way the hernia is never permitted to come down, and the opening gets a chance of becoming permanently occluded.

The Moc-Main Truss (Fig. 126) is very comfortable to the patient, but less secure than the Spring Truss.

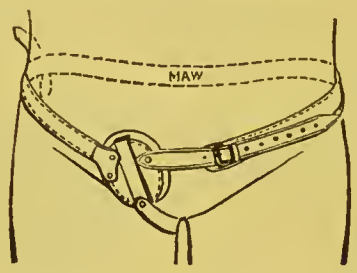


Fig. 126.

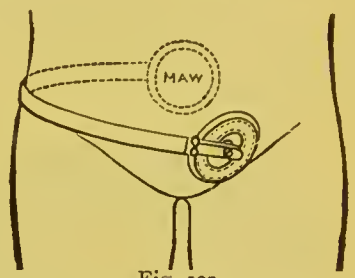


Fig. 127.

Salmon and Ody's Truss (Fig. 127) has its pad fitted on a ball and socket joint, which admits of close application, and prevents its displacement by movements of the patient. It has a posterior pad, which rests on the spine, and the spring passes round the side opposite to the hernia.

For umbilical hernia various belts and trusses are employed.

RECTAL INSTRUMENTS.—(1) *Specula* are used to separate the walls of the rectum so as to admit rays of light into the

Fig. 128.

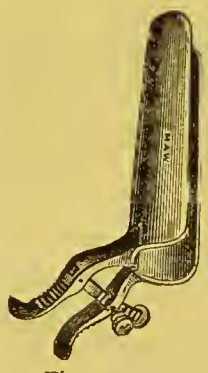


Fig. 129.

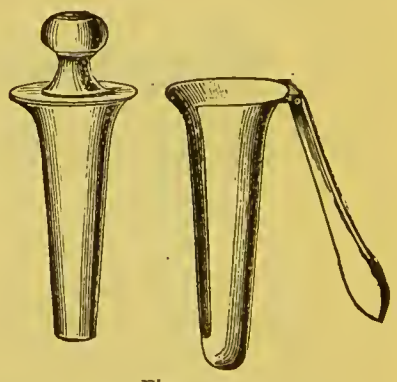


Fig. 130.

cavity to enable the parts to be examined, either for purposes of diagnosis or treatment. Direct sunlight or light

reflected from an artificial source may be employed. Many forms of instrument have been introduced—some tubular, *e.g.* Fergusson's (Fig. 128), others with two separate blades, such as Maw's (Fig. 129), and others again with three or four blades like Allingham's. Hilton's speculum (Fig. 130) is on the same principle as Fergusson's, but is furnished with a handle, and a plug to facilitate its introduction.

(2) *Rectal Bougies* are employed to detect the situation and degree of a stricture of the rectum, and for its gradual dilatation when such is possible. They are graduated to a scale, are usually made of soft gum-elastic, and the points may be cylindrical, conical, or bulbous (Figs. 131, 132).

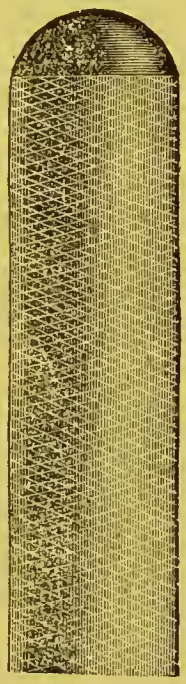


Fig. 131.

Fig. 132.

(3) *Rectal Dilators* are used to distend the tube more forcibly, the blades being separated by various mechanical arrangements.

(4) *Rectal Bistouries*, for the purpose of operating on such conditions as fistula in ano, have been introduced, but are for the most part unnecessary.

In the treatment of Hæmorrhoids several special instru-

ments are employed. *(a) Hæmorrhoid Forceps* (Fig. 133), are used to seize and pull down the hæmorrhoids. *(b) Hæmorrhoid Clamps.*—Of these there is great variety.

Fig. 133.

Fig. 134.

Some are used in conjunction with the cautery, *e.g.* H. Smith's (Fig. 134), and Sydney Jones's (Fig. 135), a plate of ivory being placed between the metal and the skin to prevent the latter being burned. Others crush the piles suffi-

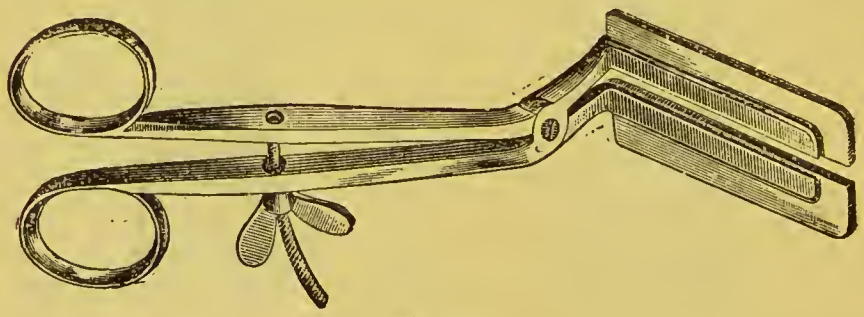


Fig. 135.

ciently to prevent hæmorrhage when they are cut off by

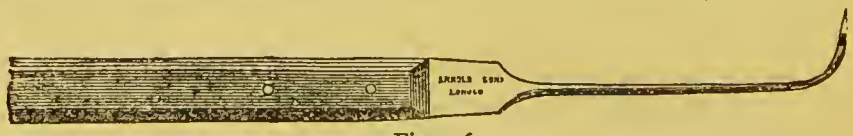


Fig. 136.

scissors, *e.g.* Allingham's. *(c) Cauteries.*—Any form

of cautery will do for treating piles, although several have been specially contrived for this purpose. *(d)* The *Hæmorrhoid Needle* (Fig. 136) is a long, sharp, curved needle fixed to a handle, and having the eye a short distance from the point. It is used to carry a double ligature through the pile, which is then tied in two halves. Others are made after the pattern of cleft palate needles, with a double curve on them (Fig. 113).

ENEMA APPARATUS.—Of enema syringes perhaps the simplest and the best is the ordinary Higginson's syringe. Others are more complicated, without any corresponding advantage. Some act on the syphon principle, and are very useful. For the administration of

Fig. 137.

nutrient enemata the instrument most convenient is a simple india-rubber bag with nozzle (Fig. 137).

Other instruments used in operations on the rectum, such as hooks, scissors, directors, and so on, do not require special mention.

Bed Pans vary much in shape and material, the *wedge-shaped* and the *slipper* (Fig. 138) being the commonest.

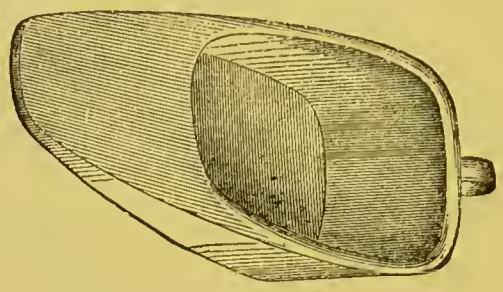


Fig. 138.

CHAPTER XXXI.

URETHRAL INSTRUMENTS.

Bougies.—These instruments are used for the dilatation of the urethral canal. They are made of various materials, some rigid, others soft and flexible, and are of different shapes, but all agree in being solid, or at least in not permitting of the flow of urine through them. They derive their name from the fact that wax tapers or *bougies* were previously used in place of specially-made instruments. They are about twelve or thirteen inches long, and vary in diameter according to a set scale, each instrument having its size marked on it.

The *Ordinary Silver Bougie* resembles the silver catheter in every respect, save that it has no eye at the point, and is impermeable. It is of the same diameter throughout.

Sir Joseph Lister's Bougies are of solid steel, and therefore of considerable weight, which greatly assists their passage along the canal, and renders force on the part of the surgeon unnecessary. These instruments are graduated so that the diameter increases by three sizes from the point upwards. Hence they come to be referred to as "Lister's 2-5" or "10-13," and so on, which means that at the point, which is made slightly bulbous for safety, the size is No. 10, and at the middle of the stem it has increased to No. 13. Of rigid instruments these are usually accepted as the best.

Various forms of pliable instrument are in use, *e.g.* the *English Gum Elastic Bougie* (Fig. 139), which is made of finely-woven silk, covered with several coats of brown copal varnish. It is of the same diameter throughout, and is rendered quite supple by being warmed to the temperature of the body. It may be made to take any "set" desired by being left bent for a few weeks.

The French Gum Elastic Bougie (Fig. 140) is black in colour, and differs somewhat in shape from the English. It is made so that the stem gradually tapers away to a point in its lower third. An improvement on this is to have the tip rounded and slightly bulbous, which prevents hitching on any obstruction in the canal. This is the *bougie à boule* of the French.

The "*Acorn*" *Bougie* (Fig. 141) is mainly used as a diagnostic instrument. It consists of a long slender stem, fitted at the point with an acorn-shaped bulb. This is so formed that it passes pretty readily in through a stricture, but is distinctly caught on being withdrawn. In this way the exact position of the stricture may be determined, and by using instruments of different sizes, an idea of the calibre of the tube at the strictured point may be obtained.

The "*Filiform*," or thread-like bougie (Fig. 142), as its name implies, is of very fine calibre, and is chiefly employed in cases of exceeding tight stricture, to determine whether or not the passage is at all permeable. If once passed it facilitates the introduction of larger instruments.

Other instruments, such as the *Ball-staff Bougie*, *bougie à ventre*, *bougie à ventre à boule*, are less frequently used.

Catheters.—These are hollow tubes made of different materials, and are used to empty the bladder. They are to be distinguished from bougies, which are solid, and are for the dilatation of the urethra. Almost every variety of bougie has its counterpart in the shape of a catheter.

The *Ordinary Silver Catheter* (Fig. 146) consists of a hollow tube, with a small "eye" on its side, about a quarter of an inch from the point. In the older instruments the part of the catheter beyond the eye formed a *cul-de-sac* in which dirt, and therefore septic material, was apt to collect, and constituted a source of danger by introducing organisms into the urine, which is a highly putrescible fluid. In more recent days this disadvantage has been removed by making the point of the instrument solid. Near the other end of the tube there are two small silver rings, which are used when the instrument has to be tied into the bladder, for constant drainage. Most catheters are furnished with a wire stylet. The lower fourth of the instrument is curved

Fig. 139.

Fig. 140.

Fig. 141.

Fig. 142.

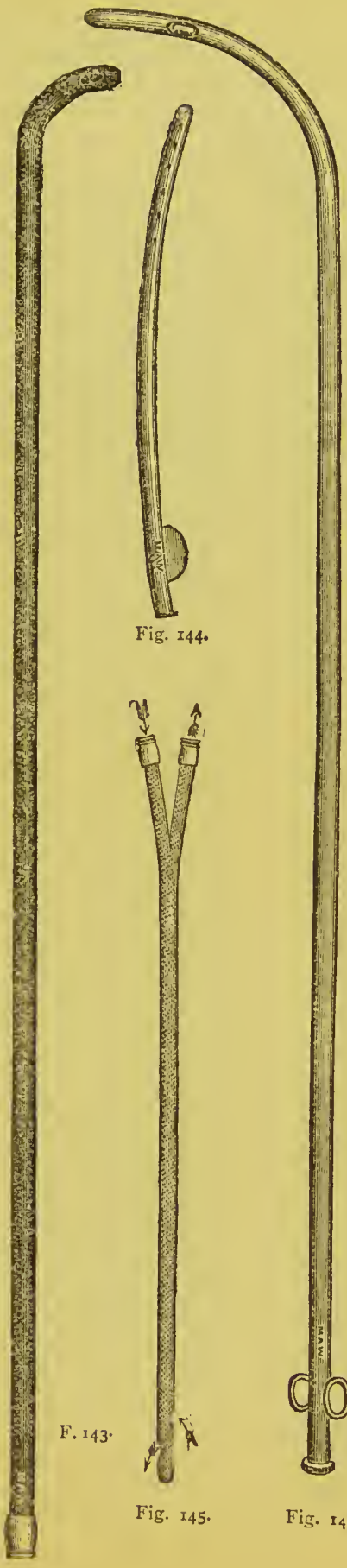


Fig. 144.

F. 143.

Fig. 145.

Fig. 146.

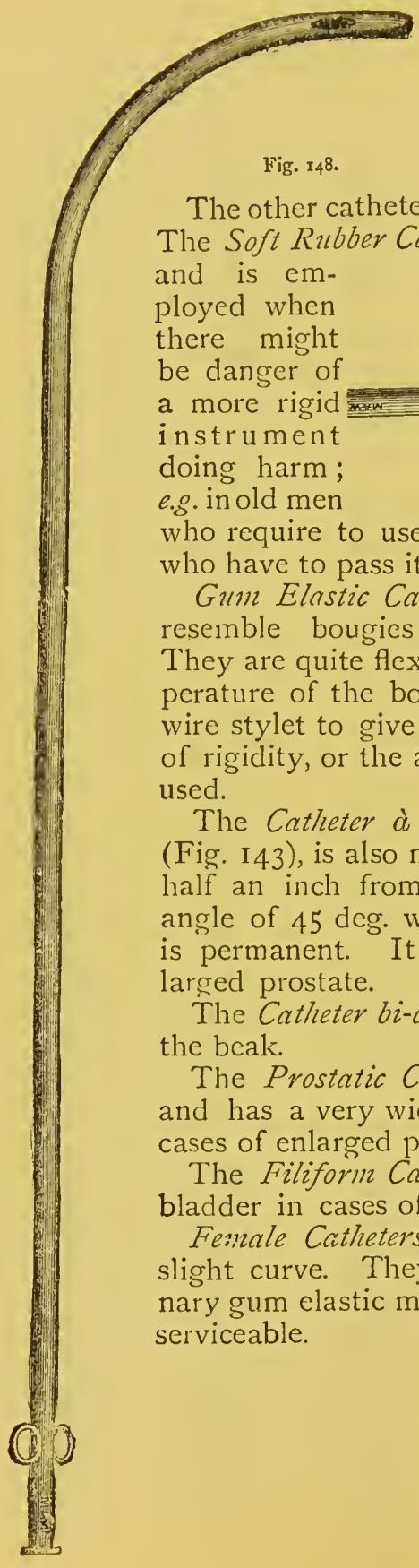


Fig. 148.

so that the point comes to be almost at a right angle with the axis of the stem. The sizes, according to the English scale, are from $\frac{1}{4}$ to 12.

The other catheters are all more or less flexible. The *Soft Rubber Catheter* (Fig. 147) is quite soft, and is employed when there might be danger of a more rigid instrument doing harm; *e.g.* in old men who require to use the catheter habitually, and who have to pass it themselves.

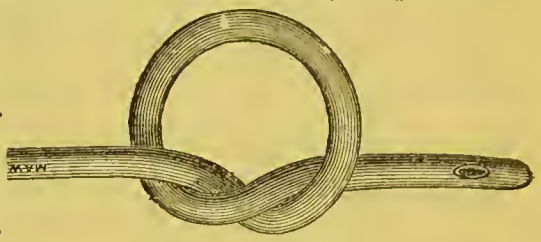


Fig. 147.

Gum Elastic Catheters (English and French) resemble bougies of corresponding makes. They are quite flexible when heated to the temperature of the body, and are supplied with a wire stylet to give them the necessary amount of rigidity, or the appropriate curve when being used.

The *Catheter à coudée*, or elbowed catheter (Fig. 143), is also made of gum elastic. About half an inch from the beak it is bent at an angle of 45 deg. with the stem, and this bend is permanent. It is employed in cases of enlarged prostate.

The *Catheter bi-coudée* has a double bend near the beak.

The *Prostatic Catheter* (Fig. 148) is of silver, and has a very wide bend. It is also used in cases of enlarged prostate.

The *Filiform Catheter* is used to empty the bladder in cases of very tight stricture.

Female Catheters (Fig. 144) are short, with a slight curve. They are seldom used, the ordinary gum elastic male catheter being much more serviceable.

The *Double-barrelled Catheter* (Fig. 145) is used to wash out the bladder, the lotion passing in along one channel, and out along the other. It may be used with a syringe or syphon.

Other forms of catheter are used in certain operations, *e.g.* lithotrity, where the bladder has to be washed out to remove all fragments of the stone. Examples of these are Clover's and Bigelow's evacuating catheters (Figs. 167 and 165), the chief characteristics of which are their large bore and the size of the eye, which is much larger than in ordinary instruments, to permit of the free passage of the stones.

Fig. 149.

Instruments used in Urethrotomy.—There are certain cases in which stricture of the urethra does not yield to treatment by means of dilatation with bougies, and it becomes necessary to cut the strictured part of the canal and so restore its calibre. This operation is known as *urethrotomy*. The stricture may be attacked from the inside of the urethra—*internal urethrotomy;* or the cut may be made through the skin—*external urethrotomy*.

When the incision is made from the inside a very fine blade is introduced, and with great care is made to cut only the strictured part. To ensure accuracy and safety many instruments have been devised and great ingenuity displayed. Some of these cut the stricture from before backwards, that is, on the way into the bladder, *e.g.* that of Maissoneuve (Fig. 149), which consists in (1) a fine filiform bougie, which can be passed through a very tight stricture; (2) on to this is screwed a small staff, in a hollow in which runs a stylet bearing a triangular shield. This triangle, or wedge, renders the stricture tense, and

from within it is pushed a sharp cutting knife edge, which splits the constricting fibres, and so re-establishes the lumen of the canal. Any fibres which may escape division as the instrument enters can be dealt with as it is withdrawn. This instrument has been modified and improved by Teevan.

Another set of instruments is arranged to cut the stricture from within outwards, but obviously very tight constrictions cannot be so dealt with, as such would not admit of the entrance of the staff with its concealed knife, and some of the instruments are so large, that if they can be passed at all it almost argues that no operation is necessary. Of instruments cutting from within outwards may be mentioned Sir Henry Thompson's modification of Civiale's instrument. It has a bulbous point, from

Fig. 150.

which a blade can be projected (Fig. 150). Dr. P. Heron Watson, of Edinburgh, has also introduced an instrument working in this direction. Otis, of New York, has a complicated instrument, consisting of two separable blades, which render the urethra quite tense, and when the knife is protruded it very readily splits the constricting fibres.

The operation of *external urethrotomy* is performed by the aid of a guide which is passed into the urethra, and being felt through the skin, is cut down upon. The most frequently used staff is that of Syme. The curved part of this instrument is about the size of a No. 2 bougie, and about three inches from the point it suddenly expands to the size of a No. 10 or 12, thus forming a distinct shoulder. The thin part is grooved on the convexity, the groove just reaching on to the shoulder and stopping there. The instrument is passed into the urethra with the patient in the lithotomy position, the shoulder is caught at the stricture, the surgeon cuts down upon the shoulder, introduces the point of his knife into the groove, and

cuts through the stricture in a direction from within outwards. The staff is withdrawn, and an S-shaped silver catheter (Fig. 151) introduced through the perineal wound,

Fig. 151.

Fig. 152.

and left for three or four days for drainage. The further treatment consists in regularly passing bougies at stated intervals to prevent recontraction of the stricture.

Mr. Wheelhouse performs external urethrotomy by cutting down upon a grooved staff (Fig. 152), which only reaches to the stricture, and then from the perineal wound he passes a fine probe-pointed director through the stricture, and on this divides the tight fibres. Drainage is carried out by a silver catheter passed through the meatus, and the perineal wound is allowed to heal up. Sometimes no instrument can be got through the stricture, and the urethra beyond has to be searched for in the perineum and opened—an operation of extreme difficulty.

Urethral Dilators.—It is sometimes advisable to rapidly and forcibly stretch a strictured urethra, and there are several methods of doing so. (1) By means of sliding tubes. The instrument used by *Wakley* may serve as a type of this variety. It consists of a fine "urethral guide," which is first passed through the stricture, and then over this a larger tube is passed, and so on, one tube over another till the urethra is expanded to its normal size. (2) *Sir Henry Thompson's Dilator* consists of two blades, which may be separated by a screw at the handle. The dilatation should be very slowly effected, a few seconds elapsing between each two turns of the handle. (3) *Holt's Urethral Dilator* acts on the principle of a wedge (Fig. 153). It is a split sound, having a fine steel wire between the two halves of the blade. The instrument is passed into the urethra, and when there, one of a graduated set of wedge-shaped tubes is passed over this wire, and so forcibly separates the halves of the sound. It is claimed by the introducer that only the strictured part of the urethra is affected by the proceeding. This method of treating stricture is not free of danger, and in most cases may be replaced with advantage by either gradual dilatation or urethrotomy.

Urethral Forceps (Fig. 154) have long, narrow blades, and are used to remove impacted calculi or other foreign bodies from the urethra.

Various instruments have been used to apply substances

Fig. 153.

Fig. 154.

locally to the mucous membrane of the urethra. For example, solid caustics may be applied by the aid of one apparatus; fluid caustics with another; and ointments by a third, which is fluted all round to receive the ointment. They are seldom used nowadays.

Of all the *urethral syringes* in use, perhaps that of Balmano Squire (Fig. 155) is the most convenient. It holds

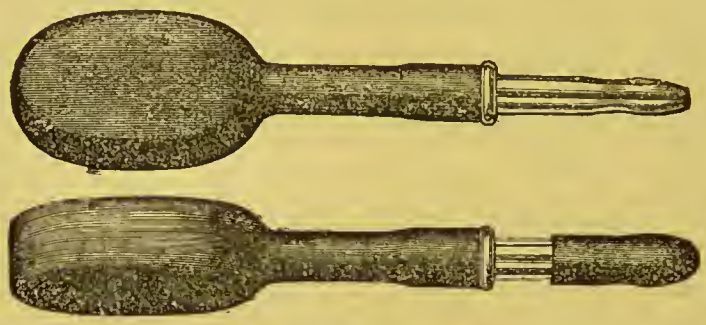


Fig. 155.

just as much as the urethra does, and is made of india-rubber with a glass nozzle, which has an india-rubber cap acting as a stopper.

CHAPTER XXXII.

INSTRUMENTS USED IN LITHOTOMY.

THE operation known as lithotomy consists in opening into the bladder for the purpose of removing from it a "calculus" or stone. This opening may be made either just above the pubis in the middle line—*supra pubic lithotomy*—or through the perineum—*perineal lithotomy*—and when in this situation the incision may be *median*, or much more frequently is *lateral*.

Lateral Lithotomy.—Obviously the first step in this procedure is to determine whether or not a stone is present. This is largely decided by the symptoms and history of the patient, but cannot be made certain without the use of an instrument called the *Lithotomy Sound*. Of these there are several varieties, the more commonly used being *Liston's Sound* (Fig. 156), which consists of a solid steel stem, with a curve somewhat smaller than that of a bougie. The handle is broad and flattened out laterally. *Lister's Sound* is made on the same model as the bougies of his name, but with a smaller curve (Fig. 157). *Sir Henry Thompson's Sound* (Fig. 158) is made of plated steel, with a straight stem and a very short, sharply-curved beak, which permits of the instrument being freely moved about inside the bladder, a proceeding which is further facilitated by the handle being small, rounded and fluted, so as to admit of fine manipulations being carried out. Some other sounds are hollow to permit of fluid being introduced into, or withdrawn from the bladder during the operation of sounding.

The presence of a stone being demonstrated, and an operation considered necessary, after the usual preparations for anæsthesia, etc., the patient has to be placed in what is known as the *lithotomy position*, *i.e.* with the legs flexed

Fig. 156.

Fig. 157.

Fig. 158.

on the thighs, and the thighs on the abdomen, the knees widely separated so as fully to expose the perineum. The sole of the foot is placed in the palm of the corresponding hand, and fixed there by means of a soft but strong bandage. As it is of great importance that the patient should be kept steadily and evenly in this position all the time of the operation, an apparatus known as *Clover's Crutch* (Fig. 159), has been devised to facilitate this. It consists of a transverse bar, which may be lengthened or shortened at will by a telescopic arrangement, fitted at each end with a circular padded strap. These straps are adjusted to the legs just below the knee, and the transverse bar keeps the knees apart. A long strap passes from one end of the transverse bar, up across the same shoulder, then crosses the back and comes out over the front of the opposite groin to be fixed to the other end of the bar. In this way the double flexion of the legs is kept up, and the desired position maintained.

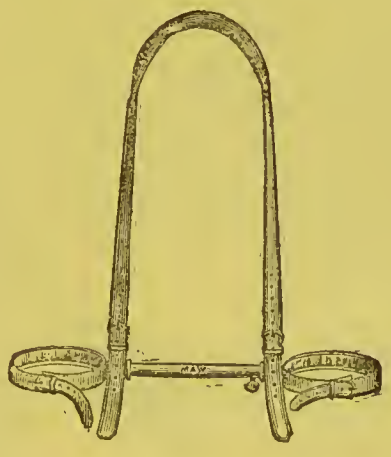


Fig. 159.

The other appliances used in the operation are the *Lithotomy Knife.* Many varieties of this knife have been introduced at different times to render the danger of the operation less, but, as Mr. Erichsen says, "they simply seek to supply by mechanical means that safety in the deeper incisions which may as readily be secured by a broad-bladed,

straight-backed scalpel, if properly guided by a hand that is ordinarily skilful." The two patterns that are most commonly used are *Liston's* (Fig. 160), which has a cutting edge only in the anterior two-thirds, and a sharp point; and *Fergusson's* (Fig. 161), which is probe-pointed.

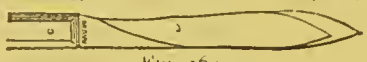


Fig. 160.

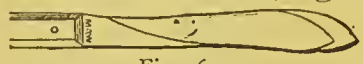


Fig. 161.

In order to open at once into the bladder, it is necessary that the surgeon should have some guide, and this is furnished in the shape of the *Lithotomy Staff* (Fig. 162), which is a large, curved, steel instrument, with a broad, roughened handle.

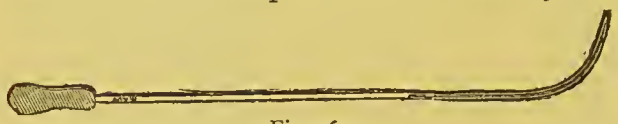


Fig. 162.

Throughout its lower half or two-thirds, it has a deep groove on its left side, and it is this groove which guides the surgeon into the bladder. The instrument is passed in the usual way, and held in position by an assistant. The surgeon then feels it through the skin of the perineum, and cutting boldly down upon it, enters the knife into the groove and runs it straight home into the bladder. Of this instrument there are several varieties, such as *Cheselden's Staff*, the oldest and most generally used; *Buchanan's*, which has the lower part set at a right angle to the stem; and *Chiene's*, in which the right angle of Buchanan is rounded off.

The next instrument used in the operation is the *Lithotomy Forceps* (Fig. 163). These are large, strong forceps, with a scissors joint, the blades being spoon-shaped, roughly serrated on their hollow surfaces, and often lined with linen or wash-leather, to prevent the stone slipping. The handles have a ring on one side for the thumb, and a loop on the other, into which the fingers fit.

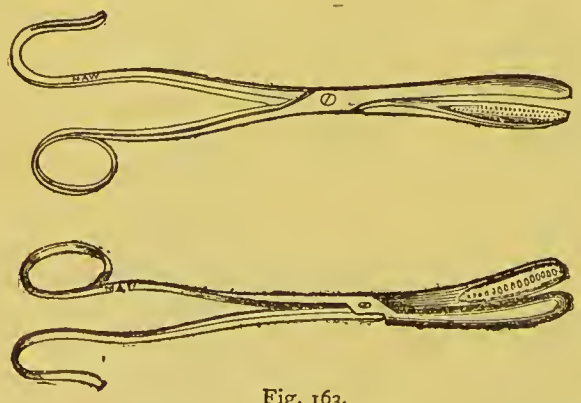


Fig. 163.

Most forceps are straight, but curved ones are often found useful. Sometimes the stone is more conveniently removed by the *Lithotomy Scoop* than by forceps. This instrument is practically a single blade of the forceps, which may or may not be roughened, set in a handle, or it may be double-ended. The finger of the surgeon acts as the second blade of the forceps. The stone having been removed it is necessary to drain the bladder through the wound in the perineum for some days by the *Lithotomy Tube*, which is a short, stiff tube of gum elastic, with a terminal aperture, and provided with silver rings, with which to tie it into the bladder. It is of great importance that the tube should be stiff, because it is sometimes necessary to plug the wound tightly to stop bleeding, and, if a soft flexible tube be used, it will be occluded, and the drainage of the bladder interfered with. To facilitate this plugging of the wound, the tube is sometimes "petticoated," that is, surrounded by a piece of linen firmly tied round it near its internal end, and hanging loosely round the rest of it. Into the *cul-de-sac* thus formed, wool or lint is tightly packed, and so pressure is exerted on the bleeding vessels.

In this operation of lithotomy, it is necessary to cut widely into the substance of the prostate gland which surrounds the most internal part of the urethra. This may be done with the knife in making the incision into the bladder, and the cut enlarged so far as needful on the way out, or a special instrument known as the *Gorget* (Fig. 164) may be employed. The small probe-pointed button at the point of the gorget is fitted into the groove in the staff, and as the instrument is pushed home into the bladder, it dilates the substance of the prostate gland.

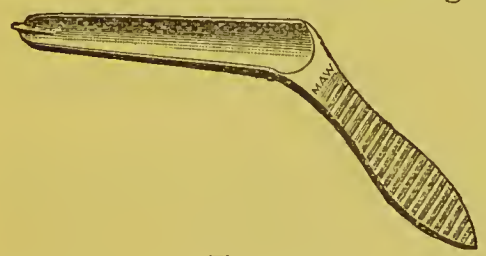


Fig. 164.

For the *supra-pubic operation* of lithotomy several addi-

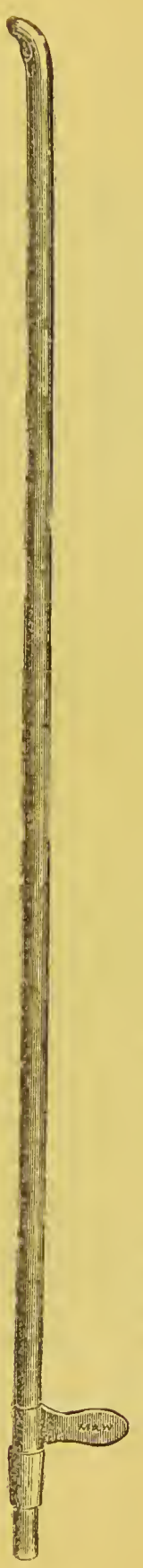


Fig. 165.

tional instruments are required. The bladder has to be filled with some tepid antiseptic lotion, *e.g.* boracic acid. This may be done through an *ordinary catheter*, by means of a syphon, or with *Thompson's Hollow Sound.* Next the bladder is pushed forward as far as possible from the rectum. To effect this, *Petersen's India-rubber Bag* is passed into the rectum empty, and then filled with lotion, which is retained by a stopcock. The incision in the abdominal wall is made with an ordinary bistoury, and the bladder is exposed with the aid of a *Separator.* After the removal of the stone, most surgeons drain the bladder through the incision, some using an ordinary rubber or glass drainage tube, furnished with a flat piece of rubber to prevent it slipping right into the bladder. Sir Henry Thompson has a specially constructed india-rubber tube with shield. Professor Chiene, of Edinburgh, uses a short glass tube, which is made to transfix a piece of large drainage tubing; the latter, lying across the wound, acts as a flange, and prevents the glass tube disappearing into the bladder. This has the advantage of being simple, efficient, and always obtainable.

Lithotrity.—The operation of *Lithotrity* consists in crushing a stone to pieces inside the bladder, and then removing the fragments by a stream of lotion.

The presence and size of the stone having been ascertained by means of a *Sound*, the *Lithotrite* is employed to crush it. This instrument consists of two blades, an inner, or "male" blade, which slides in a groove in the outer or "female" blade. The stone is caught between the two blades, and slowly crushed by approximating them by a screw.

The debris is removed by means of an *Evacuating Catheter* (Fig. 165), which has a very large eye, and one or other form of *aspirator*, which is

furnished with a trap-like contrivance which prevents the particles of stone re-entering the bladder with the in-

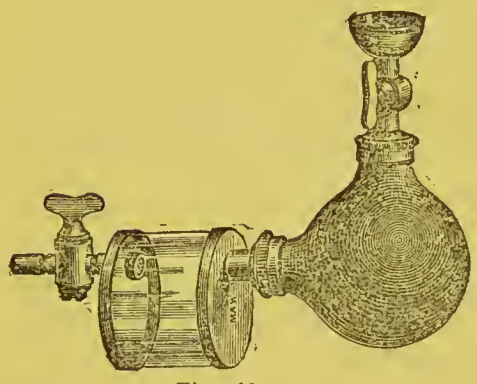


Fig. 166.

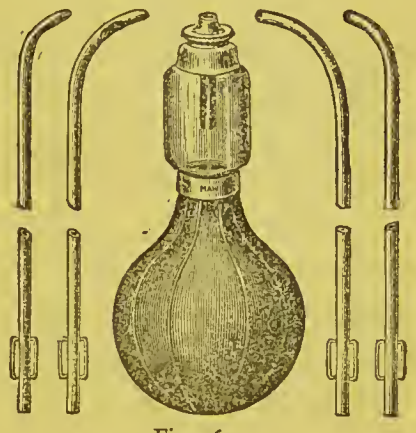


Fig. 167.

going stream of lotion. Examples of *Aspirator* are Clover's (Fig. 167), and Thompson's (Fig. 166).

CHAPTER XXXIII.

SOME LARYNGEAL INSTRUMENTS.

The Laryngoscope.—This apparatus consists of several distinct pieces: *(a) The Reflector*, which is fitted to the operator's head either by means of a forehead band, or on a spectacle framework, and is for the purpose of casting a bright light into the patient's mouth. *(b) The Laryngeal Mirror*, which is a small round mirror fixed at an obtuse angle to a long slender stem, and in which the observer sees the reflection of the parts in the larynx. There are several such mirrors of different sizes, all fitting into one handle. *(c)* For diagnostic, as well as therapeutic purposes, probes and brushes may be fitted to the handle. A *Laryngeal Syringe* is used to inject substances, such as menthol, into the larynx, and *Laryngeal Insufflators* are employed when it is desired to apply a powder to the parts. *Laryngeal Forceps*, such as those of Mackenzie, are employed in various operations on the larynx. Some open laterally, and others antero-posteriorly.

TRACHEOTOMY INSTRUMENTS. — The operation of *Tracheotomy* may be performed with a very small number of instruments, and the less specialised these are the better. A small *scalpel*, the handle of which may be used as a *dissector;* several pairs of *Well's forceps; retractors; dissecting forceps;* a *director;* and the *tracheotomy tube* are the essentials. A useful retractor for the edges of the incision in cases of emergency, may be extemporised by bending two hair-pins to the shape of the letter S, attaching one loop of each to an elastic band, while the other loops are inserted under the lips of the wound. The elastic passes

round the back of the patient's neck, and its tension holds the wound open.

Other retractors in the shape of double hooks (Fig. 168) are used when assistants are available.

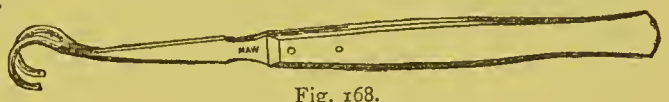


Fig. 168.

A *sharp hook* (Fig. 169) is useful in fixing the trachea while it is being opened, and being grooved, it also serves as a director.

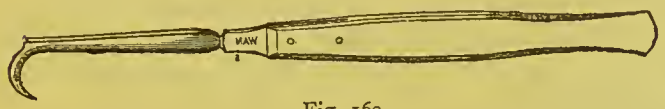


Fig. 169.

To open up the wound in the trachea in order to introduce the tube, several instruments—*dilators*—have been invented, *e.g.* Golding Bird's (Fig. 170), or Luer's (Fig. 171).

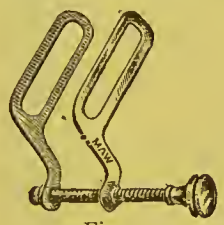


Fig. 170.

Fig. 171.

Of patterns of tracheotomy tubes there is no end, but the following are among the best. The *Ordinary Bivalve Tube* which consists of an outer and an inner tube, the latter a little longer than the former. The outer tube is fixed in position by tapes passed through the slits in its shoulder, and tied round the patient's neck. The inner tube is not fixed.

Bryant's Tube acts on a ball and socket joint which gives it free play.

Durham's Tube (Fig. 172) is provided with a vertebrated pilot which greatly facilitates its introduction.

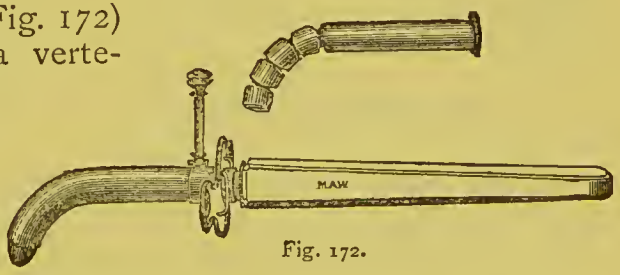


Fig. 172.

Parker's instrument (Fig. 173) has an angle on it to prevent the point causing ulceration of the trachea. For

Fig. 173.

the same purpose Morrant Baker uses a tube made of india-rubber (Fig. 174).

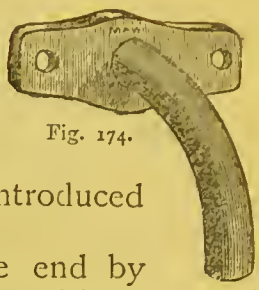


Fig. 174.

For *Intubation of the Larynx* a complicated and expensive apparatus (Fig. 175) has been introduced by O'Dwyer.

Professor Annandale attains the same end by means of a large-sized, gum elastic catheter, with a terminal aperture, and a stylet to give the instrument the proper

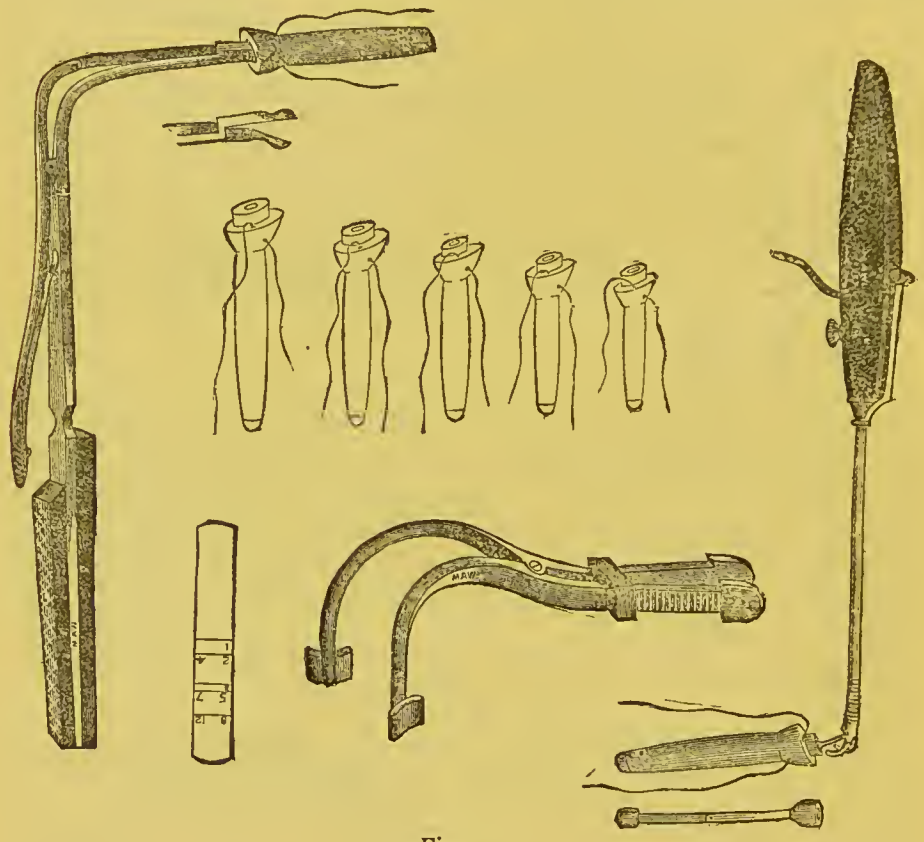


Fig. 175.

curve. To prevent the patient biting and so occluding the tube, it is passed through a rounded piece of wood, such as an empty thread-spool.

CHAPTER XXXIV

AURAL, NASAL, AND OPHTHALMIC INSTRUMENTS.

AURAL INSTRUMENTS.—In connection with the diagnosis and treatment of affections of the ear, the following are the principal appliances in ordinary use.

Aural Specula, are short conical tubes of different sizes, some being made of metal, others of vulcanite. They are employed to examine the outer ear and the tympanic membrane, and to facilitate this some are mounted on handles and have separable blades, whereby the canal may be dilated.

They may be used with direct sunlight, but usually some form of mirror or *reflector* is employed to illuminate the parts. The laryngoscopic reflector may be employed, but one with a shorter focal distance is preferable.

Aural Forceps are used to remove foreign bodies from the ear, and for other purposes. They should have an obtuse angle on their blades so that the observer's hand will be out of the line of vision.

Other contrivances have been introduced with which to remove foreign bodies from the ear, such as hooks, scoops, screws, etc. (Fig. 176), but none of these should be used until a free and full stream of lotion has failed to dislodge the body.

Fig. 176.

For removing small tumours and polypi, *Thomas's Snare* (Fig. 177) is very suitable.

The *Eustachian Catheter* is used in conjunction with *Politzer's Bag* (Fig. 178); and with the *Otoscope*.

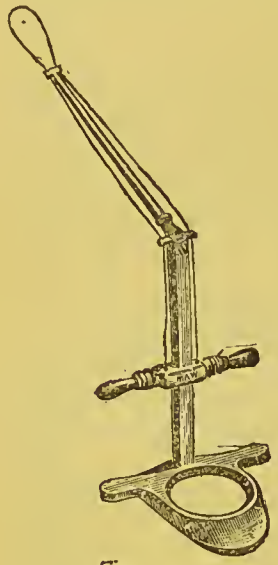


Fig. 177.

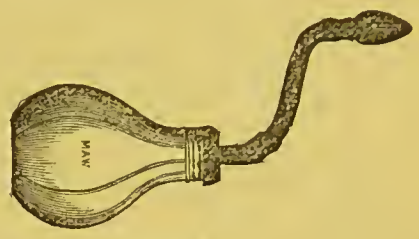


Fig. 178.

An important part of the treatment of many ear conditions consists in systematic syringing. For this an ordinary brass syringe (Fig. 179) may be used, the ear being drawn well upwards and backwards, and the nozzle placed against the roof of the canal.

Fig. 179.

NASAL INSTRUMENTS.—*Specula.*—Here again a great many forms of instrument for diagnostic examination have been introduced, *e.g. Frankels' Nasal Speculum*, that by *Lennox Browne* (Fig. 180), the *bivalve* pattern, and many others.

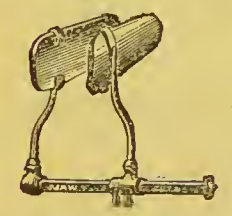


Fig. 180.

For the examination of the posterior nares a special mirror—the *Posterior Rhinoscope*—is used.

Belloc's Sound is used in plugging the posterior nares. It consists of a hollow curved stem containing

a piece of watch spring. To the latter a thread is fixed, and the sound being passed along the anterior meatus of the nose, the spring is released by a screw at the end, and it curls into the mouth, carrying the thread with it. The thread is seized and the sound withdrawn. A suitable plug now being attached to the string is pulled into position, and retained there.

Polypus Forceps are strong-bladed forceps, of the same pattern as dressing forceps, but the blades are longer, and serrated throughout on their inner aspect. Various forms of snare and ecraséur are employed for the same purpose as the forceps.

A simple and efficient form of *Nasal Douche* is shown in Fig. 181.

Fig. 181.

EYE INSTRUMENTS.—To describe the numberless appliances used in connection with ophthalmology is beyond the purpose of the present work. Suffice it to mention one or two of those most frequently employed.

The *Spring Speculum*, with a screw-stop, is most generally useful. Desmarre's *Retractors* (Fig. 182) are much used. The uses of *Fixation Forceps* (Fig. 183); *Capsular Forceps; Iris Forceps;* and *Entropium Forceps* (Fig. 184), are sufficiently indicated by their names.

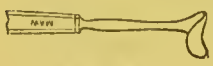


Fig. 182.

Fig. 183.

Fig. 184.

Fig. 185.

Fig. 186.

Fig. 187.

Of *Knives* we have the following:—*Canaliculus Knife* (Fig. 185); *Cataract Knife* (Fig. 186); *Linear Cataract*, or *Von Graefe's Knife* (Fig. 88); and *Iridectomy Knife* (Fig. 187).

The *Scissors* used in different operations are suitably shaped, *e.g. Excision Scissors* (Fig. 188), *Strabismus Scissors*, and *Iris Scissors*. The *Strabismus Hook* (Fig. 189) is used to catch up the

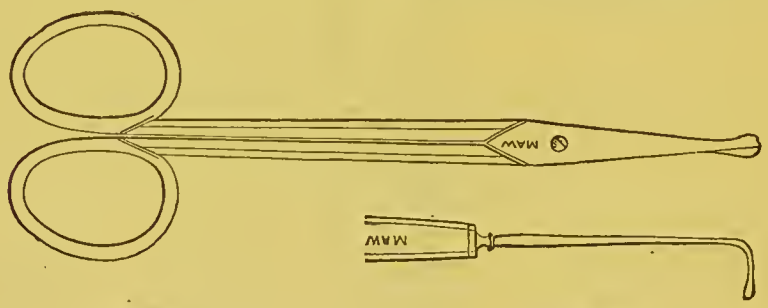


Fig. 188.

Fig. 189.

tendon to be divided in operating for squint. The *Corneal Spud* is for removing foreign bodies from the cornea.

NOTE.—For a detailed description of Eye Instruments, see "Ophthalmic Nursing," by Sydney Stephenson, M.B., F.R.C.S.E., etc. (London: The Scientific Press, Limited.)

CHAPTER XXXV.

GYNÆCOLOGICAL INSTRUMENTS.

AMONG the more common gynæcological instruments may be mentioned the following *Specula*:—The ordinary *Fergusson's Speculum* (Fig. 190), which is made of silvered glass covered externally by vulcanite, and is especially useful in examining and applying medicaments to the cervix uteri. The *Bivalve Speculum* has the disadvantage of allowing the vaginal walls to get between the blades and obstruct the view. The *Duckbill*, or *Sim's Speculum* (Fig. 191), is much used in operations; as is also *Neugebauer's* instrument A combined *Retractor* and *Speculum* is employed in vaginal operations.

Fig. 190.

Fig. 191.

Fig. 192.

The *Uterine Sound* (Fig. 192) is flexible, with a probe

point, and a knob two and a half inches from the point, to indicate the normal length of the uterus.

Dilators.—Many forms of these are employed for dilat-

Fig. 193.

Fig. 196.

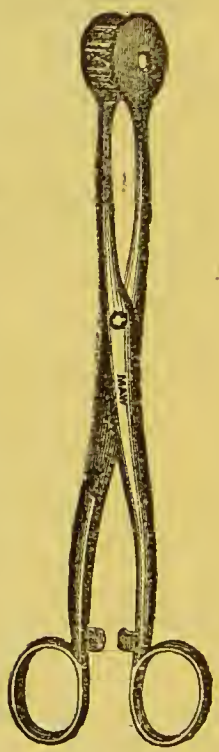


Fig. 197.

ing the cervix, of which *Simpson's* (Fig. 193) may serve as a type; various forms of tent are also used, *e.g. Laminaria*

Fig. 194.

Fig. 195.

(Fig. 194), a species of seaweed; *Carbolised Sponge* (Fig. 195), and *Tupelo*, made from the root of an aquatic plant.

Uterine Forceps are used in the removal of polypi, etc., and Figs. 196, 197, represent two patterns.

Of the special instruments used in the operation of ovariotomy, and in allied operations, it is only necessary here to mention (1) *Spencer Wells' Clamps* (Fig. 198); (2)

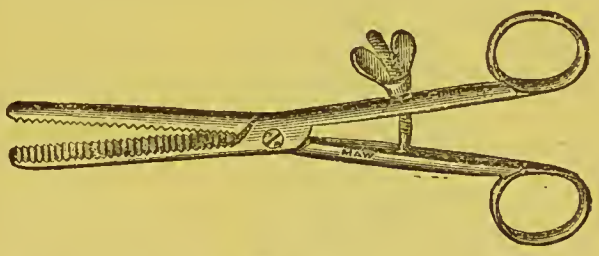


Fig. 198.

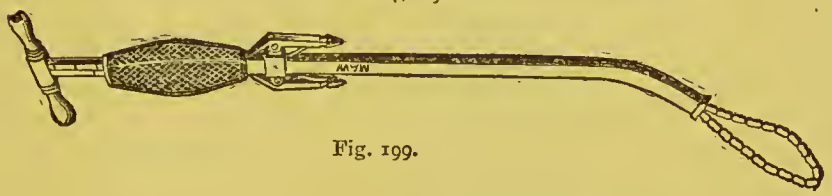


Fig. 199.

Compression Forceps; (3) *Cyst Forceps;* (4) *Trocar*, with catch for cyst-wall, and tube to convey away the fluid; (5) *Ecraseurs, e.g.*, with wire rope, and *Chassaignac's*, with chain (Fig. 199).

THE END.

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